SCIENTIFIC AMERICAN

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A POPULAR ILLUSTRATED WEEKLY OF THE WORLD'S PROGRESS

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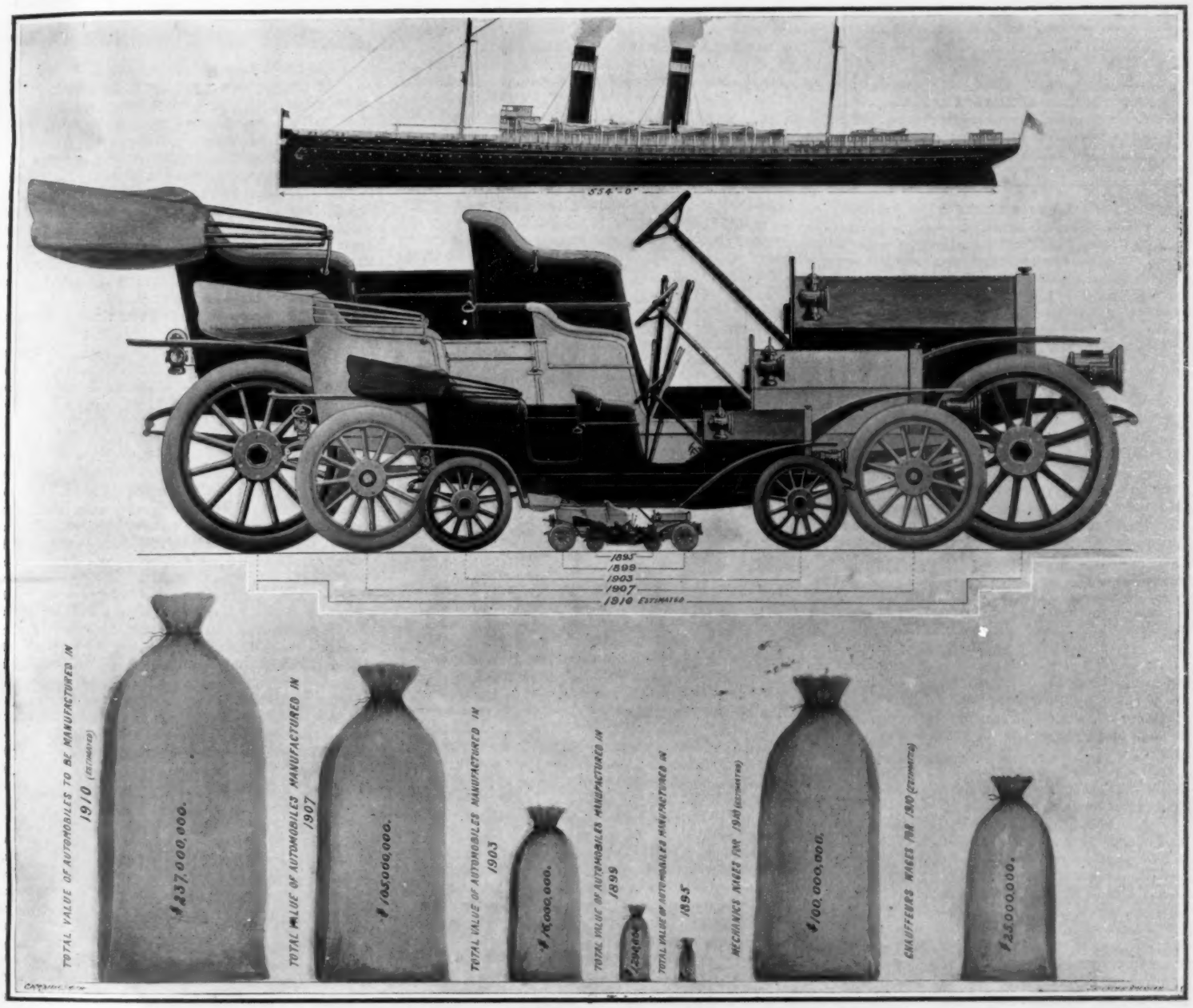
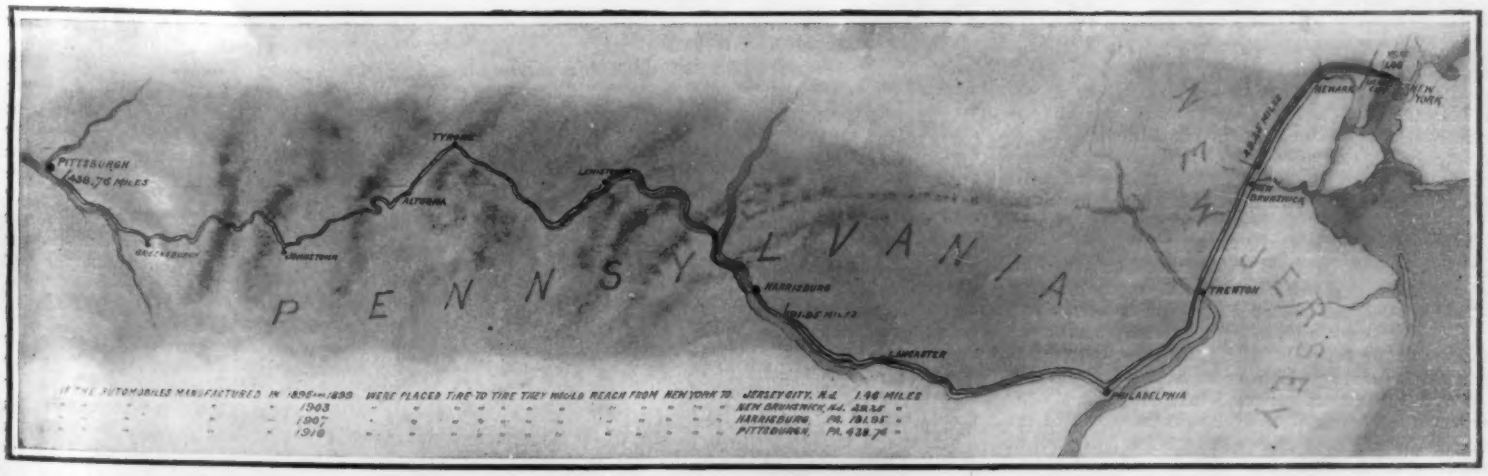


In the upper picture the Automobiles of 1895 to 1910 are compared with the "St. Paul." In the lower picture we show what the Automobile industry means in dollars.


PITTSBURGH
438.76 MILES
ALTOONA
HARRISBURG
LANCASTER
PHILADELPHIA
TRENTON
NEWARK
NEW BRUNSWICK
PENNSYLVANIA
IF THE AUTOMOBILES MANUFACTURED IN 1895 AND 1899 WERE PLACED TIRE TO TIRE THEY WOULD REACH FROM NEW YORK TO JERSEY CITY, N.J. 1.96 MILES
" " " " " 1903 " " " " " " " " NEW BRUNSWICK, N.J. 33.35 "
" " " " " 1907 " " " " " " " " HARRISBURG PA. 101.95 "
" " " " " 1910 " " " " " " " " PITTSBURGH PA. 438.76 "

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The actual geographical length of the Automobile output from 1895 to 1910.

THE MARVELOUS GROWTH OF OUR AUTOMOBILE INDUSTRY.—[See page 298.]

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ESTABLISHED 1845

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NEW YORK, SATURDAY, APRIL 9th, 1910.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

LIEUT. SHACKLETON.

HOWEVER thrilling the average man may find Lieut. Shackleton's modest and self-effacing recital of the Antarctic hardships and triumphs of his brilliant expedition, it is to the scientist that the English explorer's character must assuredly appeal most strongly. No doubt the daredevil courage of the Englishman, whose love of adventure has carried him into the heart of Africa, the wilds of Australia, and the mysteries of Thibet, enters largely into Shackleton's nature. How else could he have endured the numbing cold and the pangs of privation? But the sacrifices made during that famous expedition, which brought him within actual sight of the South Pole, are essentially scientific in character—comparable with the heroism of the man who exposes himself to the stings of disease-carrying insects, that mankind may know how best to protect itself against the ravages of yellow fever and the sleeping sickness. His modesty of demeanor and speech, his generous praise of those who accompanied him, his liberality in donating mineralogical and ornithological collections to our museums (collections made when the desire was strong to abandon them in the hour of weakness and hunger), and above all that unwillingness of his to appear as rival to Capt. Scott, his former chief, which has led him to postpone his own Antarctic plans so that Scott may have no difficulty in obtaining funds, are all characteristic of the unselfish scientist, in whom the sense of personal importance is overwhelmed by the high ideals of the cause in whose furtherance he is engaged.

Scientific, too, in its purpose is the expedition that Shackleton has postponed in deference to Scott; for that expedition will be undertaken not primarily to reach the Pole, but to fathom the many mysteries of the unknown land fronting on the South Indian Ocean, and presenting many scientific and geographic problems for solution. By systematically exploring the coast around King William Land, a coast which has never been carefully studied from shipboard because of floating ice, he will probably determine once and for all whether there is any reason for questioning the claims made by Admiral Wilkes to the first discovery of the Antarctic Continent. Shackleton's sense of fair play, his sense of scientific justice in other words, eminently fits him for this peculiarly delicate task.

The hearty recognition which Shackleton has accorded Peary for the discovery of the North Pole, coming as it does from a man who knows something of the rigors of polar exploration, ought to shame the Congress which refused national honor to Peary without proof of the North Pole's discovery. The doubt which has been foolishly cast on Peary's exploit by a congressman whose "farthest north," as one Washington correspondent phrased it, is the semi-tropical cold of Omaha, Neb., is more than extinguished by the cordial deference which Shackleton has shown toward Peary on the occasion of their many public meetings.

A PLEA FOR CO-OPERATION.

THE development of rapid transit in New York city has reached a critical stage; for upon the events of the next few months will depend the question whether a certain proportion of future subway travel is to be paid for at the present rate of five cents per trip or at double that amount.

Now, it is generally agreed that one of the indispensable conditions of the future development of the subway system in this city is that the fare shall at no time exceed five cents; for which sum a passenger must be at liberty to travel from any one part of the system to any other. The universal tendency to-day is toward the cheapening of transportation; and the possibility of an increase from five cents to ten cents per trip is not to be considered for a moment.

Nevertheless, the people of this city are to-day confronted with the possibility, if not the probability, of just such an increase of fare; and this condition is due in large measure to the strained relations between the Public Service Commission, whose duty it is to safeguard the transportation interests of the public, and the Interborough Company, which has a practical monopoly of local transportation. The Public Service Commission will shortly call for bids for the construction of an additional subway, extending from the Bronx to the Battery, which will be absolutely independent of the route which is now in operation. The new line as laid out would be an excellent one, were it not for the grave defect that nowhere does it make connection with the existing subway. This defect, however, must be made good by providing for such connections as will enable a passenger to travel for one fare from any point on the one to any point on the other system.

If we look at a map of the present subway route, it is evident at a glance that an extension of the existing lines north from Forty-second Street through Lexington Avenue to the Bronx, and an extension of the Broadway line from Times Square down Seventh Avenue to the Battery, would provide the city with two independent north and south routes. The Public Service Commission long ago recognized that this was the next logical addition to make to the present facilities, and they hoped that the Interborough Company would make a proposal for future extensions of their system over these routes. Unfortunately, the company, in offering to build these lines, has obstinately saddled its proposal with a demand that it be allowed to build a third track on one of the elevated railways of the East Side.

Now the city, as the Interborough Company very well knows, has established for all time the principle that, since the existing elevated structures are a defacement of the streets in which they stand, not only shall no further extensions be made, but, as soon as other facilities are provided, the existing structures shall be removed. Therefore, the Public Service Commission at once and very properly refused to accede to the Interborough proposal; and, ostensibly, it is upon this question of extending the elevated service that the Commission and the company are at variance.

Failing to get any satisfactory proposal from the Interborough Company, the Commission have laid out an independent route, which extends from Woodlawn and Pelham Bay Park in the Bronx to the Harlem River, and down Lexington Avenue and Broadway to the Battery. Bids will shortly be asked, and, as we have noted above, unless the Interborough should put in a bid agreeable to the conditions laid down by the Commission, the new line will be built independently of the existing subway. Thereafter, if anyone should have occasion to make a trip involving a transfer from one system to the other, he will be able to do so only by the payment of an additional fare—a condition which for a large proportion of the traveling public would amount to a positive hardship.

Now the contingency of having to pay a double fare is so serious, that it demands immediate and careful consideration. We believe that the exercise of a more liberal policy by the Interborough Company and the exhibition by the Public Service Commission of a little more confidence in the attitude and purposes of the Interborough people, would result in a compromise of lasting benefit both to the corporation and the traveling public. The Interborough Company certainly owes much to the city; and we say this with full remembrance of the fact that Mr. Belmont, at a time when capital was looking askance upon the subway proposition, came forward courageously and provided the enormous capital necessary for construction. He has received in the past and always will receive credit for the good service which he rendered to the city in a very critical emergency. But having admitted this much, we cannot lose sight of the fact that events have proved, first, that the subway property is enormously profitable, and, second, that the terms governing the relationship between the operating company and the city are very liberal indeed. If Mr. Belmont conferred a great benefit upon the city, the city has repaid him tenfold, by providing the subway line with a traffic far greater than was anticipated when the road was built.

Now the Interborough, with its magnificently equipped system, its thoroughly trained personnel, its strong financial standing, and its rich accumulation of operating experience, is obviously the interest best equipped to build and operate the new line, making it an integral part of its present system. Provided it will give reasonable guarantees, the city would just as soon, and perhaps rather, have the Interborough people build and operate the new system than any other outside interest. Unfortunately, the attitude of the company toward the city in the past, as shown in its almost contemptuous treatment of the Public Service Commission, has had the inevitable effect of producing a feeling of distrust, if not of hostility, against the company on the part of the public. This is unfortunate, unnecessary, and, to those of us who understand what a really magnificent service, judged at least from the technical side, the company is affording, it is to a certain extent unjust.

The present juncture affords a great opportunity to the Interborough Company. If it will only waive its never-to-be-granted demand for further elevated railway facilities, the city will meet the company in a liberal spirit. Should the company put in a bid for the new line, with a pledge to operate it as part of their existing system upon a single-fare basis, they will solve at once the problem of the present congestion on their own lines; they will more than double the extent of their already enormously profitable field of operations; and they will place themselves once more on a basis of amicable relationship with the people of this great city—a consideration, surely, which will not be the least weighty of those above enumerated.

A REFORM IN METEOROLOGICAL UNITS.

IN common with the other sciences, meteorology is burdened with a dual system of units. Great Britain and America continue, in a majority of their meteorological publications, to record rainfall and atmospheric pressure in inches, wind velocity in miles per hour, and temperature in Fahrenheit degrees, while all the other nations have long since adopted millimeters, meters per second, and Centigrade degrees for the same respective measurements. There have of course been many projects of reform, but only very lately has uniformity actually been attained in any branch of the science.

The United States Weather Bureau and the British Meteorological Office have definitely adopted the metric system and the degrees of the Centigrade temperature scale for recording the results of the observations made with kites and balloons—the former at its research observatory at Mount Weather, Va., and the latter at several "aerological" stations now in operation in the British Isles.

The British have gone a step further. The temperatures met with in the upper air are very frequently below the freezing point, so that the tabulated observations, expressed in the Centigrade scale, abound in negative values, which are awkward to deal with and also a fruitful source of errors in computation. The *absolute scale*, counting in Centigrade degrees from the absolute zero (—273 deg. C.) has no negative values, and the use of this scale is now common in the discussion of many physical problems with which upper-air research is closely concerned. For these reasons the Meteorological Office has begun using the absolute scale (also called the Kelvin scale) instead of the ordinary Centigrade scale in all records of temperature obtained by means of kites and balloons. A no less radical reform has been introduced in the publication of barometric pressure, in the same class of British observations. The unit adopted is a C. G. S. unit of force, viz., the megadyne per square centimeter, in place of the familiar units—inches or millimeters—expressing the height of the mercurial column. As a matter of fact, the "mercurial column" is a pure fiction, so far as the observations in the upper air are concerned, the barometers attached to the kites and balloons always being aneroids; and it is much less important to know the height of this imaginary column at any level than to know the fraction of the atmosphere that lies above or below the level. This fraction is directly indicated when the C. G. S. unit is employed, since 1 megadyne per square centimeter is practically equivalent to a barometer reading of 750 millimeters, in latitude 45 deg., which is the average pressure of the air at 106 meters above sea level in the same latitude. Hence, if we assume 106 meters above sea level as the plane of reference in barometry (and there are sound reasons for preferring it to sea level, the plane heretofore in use), the C. G. S. unit may be considered a "C. G. S. atmosphere," and the fraction of a megadyne per square centimeter recorded at any latitude gives, for all practical purposes, the fraction of the atmosphere that lies above the point of observation. This unit has been named the *bar*, and its use in all meteorological observations has been recommended by several writers during the past year.

Lastly, the Meteorological Office is now, in its kite and balloon work, recording the direction of the wind in degrees of a circle, counting from true north. East is 90 deg., south 180 deg., west 270 deg., and north 360 deg.

It is proposed to establish a wireless telegraph station at the meteorological observatory on Mount Mirador in the Philippines, to give warning of typhoons to vessels in the China Sea and points along the China coast. A similar station will probably be established later at Santo Domingo de Basco on the Island of Batan, for communicating information of the presence of typhoons in that vicinity to the headquarters of the Philippine Weather Bureau at Manila.

ENGINEERING.

The grand total of canal excavation at Panama during February was 2,602,995 cubic yards, of which 1,770,086 cubic yards was dry excavation, done principally by steam shovels. The amount taken out by the French during their occupancy of the canal was about 78,000,000 cubic yards. Under American occupation, from May 4th, 1904, to February 28th, 1910, over 100,000,000 cubic yards have been removed, leaving 74,497,000 cubic yards of excavation to complete the canal.

It is inevitable that the New York Central Railroad's huge excavation for its new station yard will be ultimately covered with buildings. An earnest of this is found in the fact that contracts have been signed for the construction of two large buildings, each of which will cover an entire city block, the new structures to face on Lexington Avenue, and to be supported on the heavy steel columns of the depressed station. The buildings, which will be known as the Merchants' and Manufacturers' Exchange, will contain 1,300,000 square feet of floor space.

The contribution of Australia and New Zealand to the British Imperial Navy will consist, in each case, of a cruiser-battleship of the same type, but larger than, the "Inflexible," which was present at New York during the Hudson-Fulton Celebration, together with three 5-000-ton, 26-knot scout-cruisers, six torpedo-boat destroyers and several submarines. Each cruiser-battleship will cost about $9,000,000, and each fleet unit about $20,000,000. They will form an integral part of the British Navy, and will be subject to the regular naval orders.

The Committee on Electrification of the New York Railroad Club, after a year's study of the subject, reports that no general information is available on the basis of which steam railroads as a whole would be justified in electrifying terminals or main lines solely on the ground of economy. They consider that more attention should be given to the possibility of electrification in connection with heavy grades, and that it is necessary to proceed with caution in attempting the electrification of large freight terminals, which necessarily involve the traffic of a number of different roads.

The Committee on Wood Preservation, in a report delivered at the annual meeting of the American Railway Engineering and Maintenance-of-Way Association, states that the average results of tests of Douglas fir indicate a decrease of the modulus of elasticity of from 10 to 15 per cent for creosoted timber, as compared with untreated timber, and a decrease of about 30 per cent in the outer stress at elastic limit and at failure. Creosoting appears to have little effect on Douglas fir in tension or end compression; but it does weaken it from 20 to 25 per cent in shear. Tests with other timbers show, as a rule, corresponding decreases in strength as the result of creosoting.

In protesting against the granting of any further vault rights under sidewalks to owners of buildings along the principal streets of the city, the Public Service Commission has drawn attention to a most important subject. Such encroachments interfere greatly with the laying out of new subways, particularly beneath the narrower thoroughfares which are found in the lower portions of the city. The commission states that in Manhattan the practice of spreading foundations beyond the building line has already gone so far that much needed space in the streets has been taken, and that if the city enforced its legal rights, the foundations of some of the large buildings would be affected.

It is gratifying to learn that the latest battleships of the United States Navy are not only living up to their contract speeds, but in recent 4-hour trials under full power at forced draught have even exceeded the original contract performance. The latest instance of this is the case of the "Louisiana," which, according to a dispatch to the Navy Department from Rear Admiral Schroeder, recently on a 4-hour full power trial maintained an average speed of 18.942 knots, and this in spite of the fact that she drew about 16 inches more water with about 1,000 tons greater displacement than on her contract run. The "Michigan" also made 19.42 knots, which is about a knot above her contract speed.

The recent frightful accident near Green Mountain, Iowa, in which forty-seven lives were lost through the telescoping of two wooden railway cars, again draws attention to the danger that lurks in wooden construction when the cars are subject to the crushing and telescoping effect of a collision. The heavy train of thirteen coaches was drawn by two locomotives which were running tender first. The foremost tender jumped the track in a railway cut, and the engine, swinging around, became tightly wedged, causing the huge momentum of the train behind to be expended in telescoping into each other the day coach and smoker in which the fatalities occurred. Had the cars been of steel the fatalities would probably not have been one-fourth as many.

ELECTRICAL.

An electric elevator has been installed in the stairway which leads to the cupola of St. Peter's Church in Rome. The elevator has a capacity for carrying ten persons. It bears an appropriate Latin inscription.

A new combined electric and steam cooking range has recently been patented, which is particularly adapted for use in hotels. The range is divided into two compartments, one of which is heated by steam, while the other is electrically heated. The latter is used for cooking, while the steam is used for heating the ovens. It is claimed that in this way a steady supply of heat is obtained very economically.

The Brooklyn Rapid Transit Company recently changed the form of brake used on its cars, adopting a "graduated-release, quick-recharge" type. In order to teach the motormen the best way of using the new brakes, an air-brake catechism has been issued, and lectures have been given on the subject. In the meantime a text-book is being prepared showing in detail how the brakes are arranged and how they should be used.

The Berlin police department is provided with an extensive typewriting telegraph system. There are about 200 receiving stations throughout the city and suburbs. The sending instrument is provided with a keyboard, and when the keys are depressed they cause the message to be printed simultaneously at the sending station and at the receiving station. The object of this system is to do away with the confusion of the Morse code. If the Morse code were used, it would have to be transcribed before a message could be put in the hands of the officer to whom it was sent.

A series of experiments was recently made at Johns Hopkins University to determine the dielectric strength of air. It was found that the point at which a brush discharge occurred is only slightly affected by the moisture in the air. From dry air to saturated air there is a drop in voltage of the discharge of less than 2 per cent. An increase of temperature from the freezing point to 40 deg. Cent. caused the lowering of voltage by about 3 per cent. Very curiously it was found that the size of the conductor materially affected the ionization of the air.

An investigation into the conductivity of electric insulators was recently discussed in the Physikalische Zeitschrift. It was found that hard rubber is greatly affected by light, particularly ultra-violet rays, and that gutta percha is similarly affected, though not to the same degree. Chemical action appears to take place on the surface of the insulator, which produces a conductive coating. Sealing wax and paraffine are also affected to a degree by light, but they are more subject to breakdown because of moisture. The conductivity of wood is to a far greater degree increased by moisture. Glass makes a very erratic insulator, the same rod of glass may have parts that differ materially in conductivity. The investigation also brought out the fact that the insulating qualities of all insulators decrease with an increase in temperature.

About a month ago one of the Edison storage battery cars was placed on the Twenty-eighth Street crosstown line as an experiment. The car has been in constant operation since, and has required no alterations or repairs other than are common to the ordinary street car. It has proved remarkably economical in the consumption of power. Instead of costing two cents a mile, as was at first stated, the actual cost of the car has been less than half a cent—0.43 cent to be exact. It costs more to start and stop the car than to keep it running, and it was supposed by practical street railroad men that when the car was put into active service on congested streets, the cost of running it would far exceed the estimate made by the builders. So satisfactory have the experiments with this car proved, that an order has been placed with the Edison Company for sixteen more to be used on the Twenty-eighth Street crosstown line.

A decidedly novel wireless telegraph detector has recently been invented by Prof. Rossi of Turin. It depends upon the torsional vibration of a fine iron wire, which is acted upon by magnetic lines of force that have a spiral direction. The wire is stretched close to two permanent magnets with like poles adjacent, and is also placed in the center of a coil through which current is passed that sets up a helical flux. When the current through the coil is rapidly alternated the wire vibrates circularly, that is, it has a reciprocal rotary motion. At the center of the wire is a mirror which reflects a beam of light on a screen. The vibration causes the light to spread out into a line whose length depends upon the amplitude of the vibration. When connected with an antenna, the oscillatory currents set up therein cause variations of the vibratory movement of the wire. The wire has a natural period of torsional vibrations, and this being known it is possible to attune the instruments at the transmitting station to produce a maximum effect on the screen.

SCIENCE.

Mr. Henry Wilde, F.R.S., of Alderley Edge, is providing Oxford University with funds for the institution of an annual lecture as a memorial of Halley.

A monument to Horace Wells was unveiled on March 7th in the Place des Etats Unis, Paris. Wells was born in Hartford, Conn., in 1815, and was a pioneer in the use of nitrous oxide gas in dental operations. He committed suicide in New York in 1848.

We have read somewhere that Peter the Great, when he was staying in England, had a particular liking for the companionship of Halley, and that after carousing with him at Deptford one evening he wheeled him in a barrow through a yew hedge and did such damage that he had to pay handsome compensation to John Evelyn, the owner, which incident shows that Shakespeare was right in thinking that not every astronomer plucks his judgments from the stars.

Gold is usually classed among the metals which are soluble only in aqua regia, i. e., a mixture of nitric and hydrochloric acids. It has been observed, however, that hydrochloric acid alone is able to dissolve gold, in the presence of certain organic compounds, which are here arranged in order of activity: Methyl alcohol, amyl alcohol, chloroform, ethyl alcohol, chloral hydrate, phenol (carbolic acid), cane sugar, glycerine, trioxymethylene, formaldehyde. The solution takes place slowly in the cold, but is accelerated by heating.

The Meteorological Office at London and the Deutsche Seewarte at Hamburg carried on jointly in February, March, and April of last year, and again in August and September, an elaborate investigation with regard to the use of wireless weather reports from vessels in weather forecasting. The co-operation of the principal British and German transatlantic steamship lines was secured, and each of their steamers sent reports twice daily while they were within a prescribed zone of the ocean. The net result of these experiments was that a majority of the reports arrived too late to be of any service to the forecaster. It appears unlikely that the meteorological institutes will feel encouraged to take any further steps in this direction until the delay in transmitting messages from ships to shore stations is much reduced. The Seewarte has announced that of the messages received promptly enough to be utilized by the forecaster, during August and September, none led to any modification of the forecast as based on reports from land stations; but it is admitted that this might not have been the case with a different disposition of the weather conditions over the ocean.

The Austrian State sale of radium has been entrusted to the "Bergwerks-produktenverschliess-Direktion" in Vienna, under the control of the Austrian Minister for Public Works. The radium is sold in the form of radium-barium chloride of three different grades, the price for each milligramme of radium chloride, including the containing cell, being 400 kronen. It is packed in cylindrical cells of 21 millimeters diameter and 9 millimeters long, formed of nickel-plated brass. On the bottom of the cell a layer of lead is cast, in which is a square depression for the reception of the radium-barium chloride. The cell is closed by a mica plate held in position by the screwed-on upper part of the casing. On the bottom of the casing is an official stamp (an eagle) and the series number. Radium cells sealed with lead, and stamped on the soldered part, are also supplied. The cells are packed in cotton and sheet lead in a small box, together with a certificate bearing the number of the cell, and the weight and radium-content of the preparation. The boxes are sealed with strips bearing the numbers of the cells, and are despatched by post as registered packets at the cost and risk of the purchaser.

Upward of twenty different systems of storm signals are at present used by the maritime countries of the world. A uniform international code is a desideratum, and the task of devising one was intrusted by the International Meteorological Committee to a small commission, which met in London last summer and agreed to recommend to the committee the adoption of a code proposed by Prof. Moore, chief of the United States Weather Bureau. This code substitutes a few simple combinations of the large conical symbols now used at a majority of the European ports for the storm flags heretofore used in the United States and some other countries. Combinations of red and white lanterns are to be used at night to convey the same information as the day signals. The proposed code has not yet, however, been formally adopted by any government, pending the decision of the International Meteorological Committee, which meets in Berlin next September. Since the London meeting objections have been raised by the German authorities to the proposed night signals on the ground that they are not sufficiently distinctive and might be confused with other harbor lights. The Deutsche Seewarte at Hamburg is now experimenting with several systems of night signals, and will lay the results of its investigations before the committee.

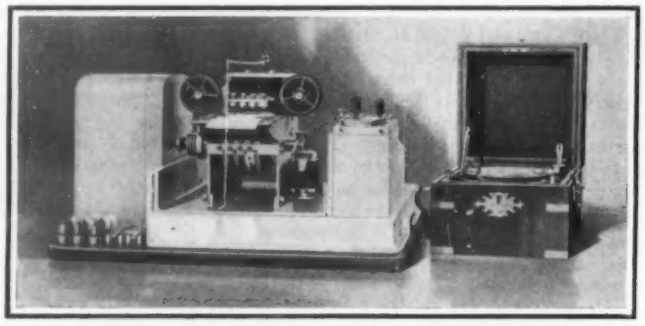
TIMING AN AUTOMOBILE RACE

AN AUTOMATIC INSTRUMENT THAT TAKES THE PLACE OF A STOP-WATCH

Even the casual reader has no doubt observed that automobile records are now expressed in hundredths of a second, whereas but a few months ago it was impossible to obtain any greater precision than fifths of a second, all of which indicates that the use of the time-honored split-second stop-watch has been outgrown in automobile races. When one stops to think about it, it is really absurd to try to time an automobile traveling anywhere from a mile to two miles and over per minute with an indicator that crawls at a snail's pace around a dial but an inch and a quarter in diameter. In the recent race at Ormond, for instance, where the mile record was reduced to 27.33 seconds by Barney Oldfield, he was traveling nearly 200 feet each second, which is equivalent to the length of an ordinary New York city block. When automobiles were first used for racing purposes, they were timed by hand with stop-watches. But, wherever an operator is depended upon to snap a stop-watch, inaccuracies are apt to creep in, due to the fact that one person is quicker of perception than another. The timer must see the start of the race, and as soon as this impression is received must start his watch; then at the close of the race the same operation must be undergone to stop the watch. The time required for this mental and physical operation varies in different persons, and is known as the personal element. Not only does it vary with different persons, but with the same person at different times, depending upon his mental and physical condition. For this reason, even in the timing of foot races it was long ago found necessary to have three timers and to take the time of the middle watch, for the instruments of the three timers varied as much as three-fifths of a second.

Early in the history of automobile racing an effort was made to eliminate the personal element by having stop-watches snapped automatically by the cars themselves making or breaking an electrical contact when they crossed the starting and finishing tapes. But, as we have just pointed out, even with the personal element eliminated, stop-watches are entirely too slow to record the time of so rapidly-moving an object as a racing automobile. The experiment of using a chronograph was tried in several of the races last year, but as this did not prove very satisfactory, Mr. C. H. Warner of the Warner Instrument Company determined to make a special instrument particularly adapted for this purpose. This instrument was first used at Atlanta last December, and has just been employed for timing the Ormond and Daytona races. It works with the utmost precision, is entirely automatic, and makes a printed record of the race, reading to hundredths of a second. The necessity of such great refinement of timing will be appreciated when one considers that the "Lightning Benz" during its record mile run was traveling at the rate of 23.18 inches at every hundredth of a second.

Mr. Warner's instrument consists of four type wheels, one of which indicates hours, the next minutes, the third seconds, and the last one-hundredths of a second. The wheels are operated after the manner of an odometer instrument. Over the wheels runs a strip of paper, and above that a typewriter ribbon, and a record is made by a hammer actuated by an electro-magnet, which strikes the ribbon and paper against the type wheels. In the circuit of the magnet which operates the hammer is a relay switch controlled by an electro-magnet in a circuit that is normally closed. This closed circuit is connected with the starting and finish tapes, or with tapes at other points where it is desirable to record the time. The tape consists of a wire stretched across the course at a height of a few inches above the ground, and this wire is connected, to a switch ingeniously constructed to be opened by the shock, rather than an increase of tension when the wire is struck by the wheels of an automobile. When the switch opens the instrument prints a record. The type wheels are frictionally mounted on a driving shaft, which is rotated by an electric motor. At the start of the race they are held stationary, and are not released until the starting wire is depressed, when they print zero and they begin their revolutions. The hundredths wheel makes a revolution every two seconds.



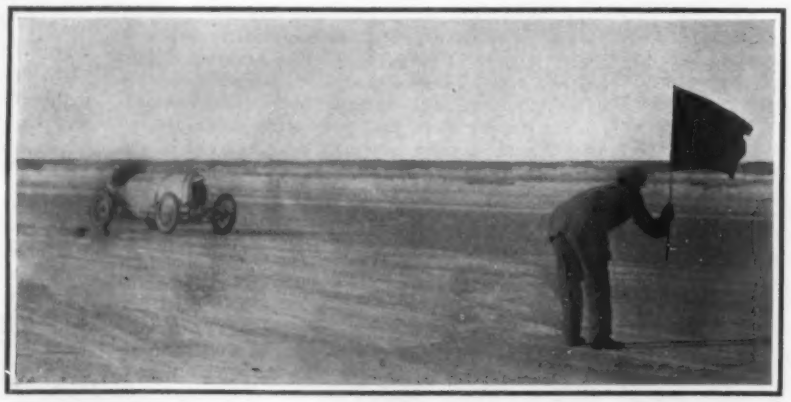
An instrument that times races to hundredths of a second.

Obviously, the most important part of the instrument is the regulation of the electric motor which drives the type wheels. It is impossible to construct a motor so perfect, or a storage battery that will discharge so uniformly, that there will be not the slightest variation in the rotation of the driving shaft. However, the instrument is so arranged that at the end of every second its speed is automatically checked up with an accurate chronometer. At one end of the driving shaft is a doublearmed lever, and in the path of this arm is a small catch connected with the armature of an electro-magnet. The chronometer acts through a relay circuit to energize this magnet every second, thus moving the catch out of the path of each arm of the lever. The motor is regulated to turn the shaft ever so slightly faster than one turn in two seconds, so that each arm strikes the catch just an instant before it is withdrawn. Secured to the base of the instrument at one side is a little "telltale" indicator, forming the armature of an electro-magnet. The circuit of the magnet is closed whenever the arm and catch contact, thus giving the "telltale" a slight throb every second. The operator of the instrument watches this "telltale," with one hand on the governor of the electric motor, and if the "telltale" indicator lingers too long at each contact of the arm and catch he slows up the motor a trifle, whereas if the "telltale" fails to register a contact he speeds up the motor slightly, so that the arm will strike the catch just before or at the moment that the catch is withdrawn by the chronometer. In this way a very accurate check is kept on the timing of the motor, which can be regulated to within 1/1,000 of a second of the speed of the chronometer.

Switching in the instrument as a car is approaching the tape.

In order to avoid a false start due to a person's walking against or tripping over the tape lines, the timing instrument is cut out of circuit with the starting lines until just before an automobile is about to touch them. An assistant gives a signal to the operator of the instrument at the proper time, and he throws in a switch just in time to catch the record of the automobile. At the same time the assistant calls out the number of the automobile, which the operator enters on the paper strip alongside of the registered time. When the car reaches a distant wire, the fact is communicated to the operator's assistant by telephone. It will be observed that no personal element whatever enters into the recording of the time made by the machines, and that everything is automatic except the regulation of the speed of the motor and the entering of the automobile numbers opposite the records they have made.

One of our photographs shows Barney Oldfield in his "Lightning Benz" just as he is approaching the finish line. The other photograph shows Mr. Warner in the timing stand about to take the record of the approaching car.



Barney Oldfield approaching the finish line at the end of his record mile run.

TIMING AN AUTOMOBILE RACE.

To Remodel the House of Representatives.

Because the acoustics of the House of Representatives are so bad that it is almost impossible for the Speaker to hear a member of the House, unless that member has lungs of leather, plans have been drawn and all preparations made for a transformation of the lower house of Congress.

For many years now there has been trouble in the House both in the way of acoustics and with ventilation. For such a large body, these two principal features have not been as they should be. The plans in contemplation will remedy these defects, and make the House one of the finest legislative chambers in the world.

One of the main ideas to be put into execution is the reducing in size of the chamber. In this way it is thought that with smaller quarters, doing away with some of the galleries, and by narrowing the chamber, the acoustics will be all that could be desired. The ventilation will also be arranged to better advantage.

The plans as contemplated also bring the House of Representatives in the same fashion as the British House of Commons. In this manner benches and small shelves will take the place of the desks and easy chairs now used by the members. The benches will resemble in appearance the chairs used in theaters. By taking away the desks and easy chairs, it is thought that those members not interested in the debates or speeches will absent themselves from the chamber.

The floor of the present chamber has an area of nearly 8,000 square feet. The floor plan of the proposed hall will only be about 6,200 square feet. The seating capacity of the new hall will be 420, although there are now less than 400 members of the House.

Some of the lobbies and extra rooms will be cut out, and the reduction in size of the hall will, of course, result in the reduction of the public galleries, whose seating capacity will be reduced about one-third.

Owing to the peculiar conditions of the hall, with regard to the acoustics and ventilation, many members while away their time by conversing with each other in loud tones or add to the confusion by slamming their desks or kicking the cuspidors. Experiments are being made now for a noiseless cuspidor and one which cannot be kicked around.

Congress has already appropriated over half a million dollars for the transformation, and the workmen are waiting for the adjournment to begin operations.

A FINE LONG-SPAN MASONRY ARCH BRIDGE

BY OUR ENGLISH CORRESPONDENT

There has been erected on the new Bellegarde-Chizery electric railway in France, a masonry bridge which in span and height ranks as the largest of its type in the country, and which possesses many interesting features. The bridge is situated in the Department de l'Ain, and is in close proximity to the frontier of Switzerland in the canton of Geneva. This imposing structure was designed and erected under the supervision of Monsieur Picard, engineer in chief of the Bridge Department, to whose courtesy we are indebted for the accompanying illustrations and details, and Monsieur Dor, road surveyor in chief of the department.

The new railroad passes through the wildest and most picturesque spots of the Jura Mountains, and in its location follows the course of the Valserine stream, a tributary to the Rhône. This rivulet is crossed twice, first by means of the Bellegarde viaduct, comprising seven spans, each of 60 feet in the clear by 150 feet in height, and secondly by a handsome masonry bridge, the "Moulin des Pierres," or "Montangas," which has a main span of 262 feet 9½ inches.

At the latter crossing the river flows through a deep rock gorge, the precipitous banks of which are over 170 feet in height. The rock was found to be of such excellent bearing quality that the engineer in chief decided to use the cliffs as the abutments of a large single arch. The latter, in springing from the sides, has a radius of 164 feet ½ inch for the arc at the intrados, and of 177½ feet at the extrados. The thickness of the masonry at the keystone is 4 feet 11 inches, and at the springing 8 feet 2½ inches, while the width is 17 feet 10½ inches, increased at the coping to 20 feet 8 inches between parapets, which is sufficient to provide width for two foot pavements, a railroad track of meter gage, and a roadway paralleling the railroad track.

The eleven small arches which surmount the great span on either side have semicircular openings of 17 feet 4½ inches clear. They are carried on piers having a thickness at the top of 3 feet 5¾ inches, and the sides parallel with the axis of the stream have a batter of 1 in 10 from the point at which they rise from the main arch.

Owing to the depth of the ravine, the erection of such a large single-span bridge called for some extensive framework. As the keystone of the main span is approximately 217 feet above the level of the water, it was necessary to erect wooden falsework from the stream to the level of the abutments to carry the centering, and this temporary work comprises three substantial towers built of wood and strongly braced together. The towers were each some 133 feet in height, and were erected on masonry piers 13 feet in height, built on piles driven in the bed of the stream.

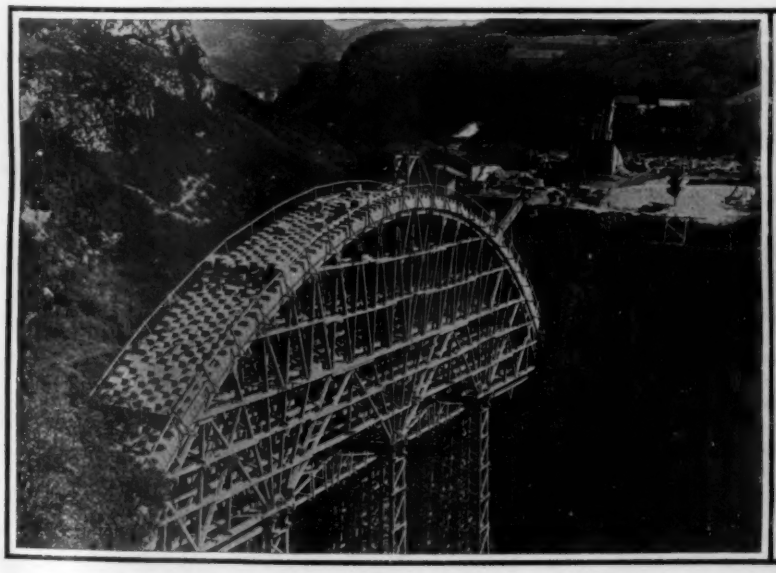
In erecting the towers it was imperative that ample provision should be made for wind pressure, as the storms which drive through this ravine are often of extreme severity. This was accomplished by tying the towers to each other and to the embankment rock and the pier bases by steel cables, so arranged as to provide a system of bracing, which served to hold the whole of the falsework perfectly rigid. The intricate character of the timber centering is plainly visible in the accompanying illustrations; and it may be mentioned that in this part of the work 21,188½ cubic feet of wood and 30 tons of iron and steel were used.

Timber falsework ready for the laying of the masonry.

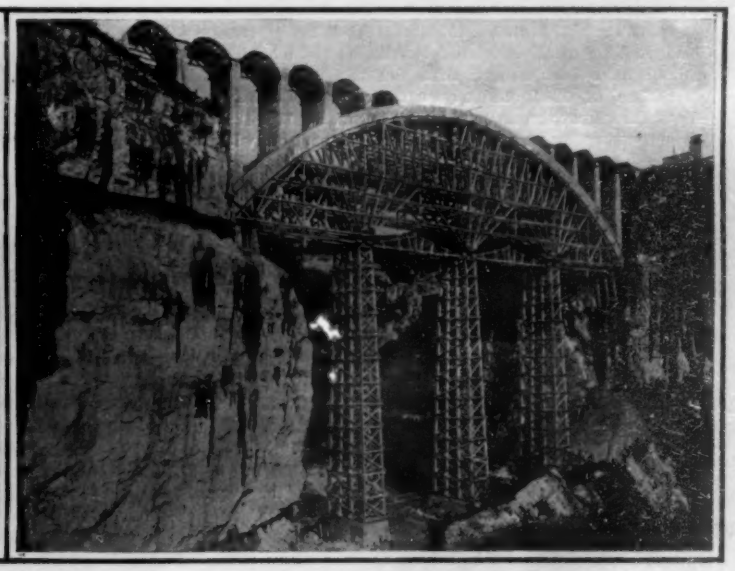
In placing the masonry in position care had to be observed to guard against any sinking of the timbering under the superimposed weight; and in order to lessen the extent of any deformation from this cause, the engineers caused the stonework to be laid in eight sections, independent of one another, which were finally connected together. An aerial cableway was erected across the gorge, by means of which the timber piers, centering, and arch were erected, the whole of the material being conveyed to its site and set in position by this means.

The bridge was commenced in August, 1908. By January 17th of the following year the whole of the timber falsework had been set up, and the erection of the masonry was completed by August 31st last. When the masonry work was finished the timbering was dismantled. The removal of the centering was accomplished by emptying the boxes filled with sand on which the various parts of the falsework frame rested, which dropped the whole of the timbering sufficiently to enable it to be handled. The falsework was demolished without any movement being noticed in the masonry, by November 7th last. When completed the bridge will excel in span any similar work existing in France; while its height over the valley, which is equal to that of the towers of Notre Dame in Paris, is greater than that of any other large single-span masonry bridge elsewhere in the world. Its total cost will approximate $72,000.

According to the Electric Railway Journal, experiments with a method of increasing traction by magnetic wheels have been conducted for some time by Mr. O. Heinze, of Lowell, Mass. The wheel contains four magnet coils, outside of which are four segments comprising part of the tread of the wheel, and a ring of 12 per cent. manganese steel is clamped between them and the wheel proper to send the magnetic circuit into the rail. The energizing of the magnets is so timed that each succeeding section of the wheel is attracted to the rail just in advance of making contact with it, so that the device, besides giving increased adhesion, also assists acceleration. The current is cut off from each given segment as soon as it is no longer in contact with the rail. Tests have been made on a truck equipped with two 35-horse-power 500-volt standard railway motors, and weighing 13,000 pounds. With the traction due to weight alone the motors developed a drawbar pull of 2,500 pounds. With the wheels magnetized, the tractive effort was increased to 8,500 pounds; or more than 300 per cent. The inventor does not claim to increase the traction by such a liberal percentage on an ordinary car, but states that a car equipped with his device should be able to mount grades that are otherwise impossible without a rack.



The masonry of the main arch was laid in eight independent courses.



The arch has a clear span of 262 feet 9½ inches; it stands 217 feet clear of the river.

BUILDING THE MONTANGAS MASONRY ARCH BRIDGE.

OUR MARVELOUS AUTOMOBILE INDUSTRY.

If ever an industry has grown by leaps and bounds, surely it is that of making motor cars. Even the bicycle in its palmiest days did not produce machines whose total value for ten years could equal the truly enormous sum of money represented by the automobile products made in the United States between 1895 and 1910. Mere figures tell but little. For that reason we have presented on the front page of this issue a graphic illustration, in which the wonderful strides made in the manufacture of motor cars are tellingly depicted. These strides are all the more remarkable when it is considered that the industry had to weather the severe financial depression of 1908, a period which was one of the most critical in the recent financial history of this country.

Considered merely from the standpoint of money, the automobile industry in this country presents a most wonderful spectacle. The total estimated value of automobiles to be manufactured in 1910 is $237,000,000. When the industry was born in this country, which was in 1895, the estimated value of the machines turned out was only $157,000. In the brief space of twelve years, therefore, we have created an industry whose annual product is valued at millions. The intermediate stages between 1895 and 1910 show a growth which is stupendous. The stage from 1895 to 1899 marked an increase in the total value of nearly a million dollars, the actual value of automobiles manufactured in 1899 being $1,290,000. Still more remarkable is the development from 1899 to 1903; for the valuation of the automobile product in this country increased nearly sixteen fold in that time, the actual value of automobiles produced in 1903 being $16,000,000. Remarkable as that increase undoubtedly was, it was almost equaled by the interval from 1903 to 1907; for in 1907, $105,000,000 worth of automobile machinery was manufactured. From the year 1907 to 1910 a 100 per cent increase is to be expected. In other words, in these three years the mere increase in value of the automobile industry will be greater than the total value of the industry in the year 1907.

An industry which has grown with such startling rapidity, and which is valued at so princely a sum, naturally gives employment to an army of mechanics, all of them skilled men handsomely paid. Thus we find that the mere wages paid for mechanics in 1910 will amount to about $100,000,000. The chauffeurs who drive the many cars which were in use in 1910 will earn $25,000,000 at the very least in 1910.

The number of automobiles produced is nothing short of staggering. If all the cars of 1910 were placed end to end, they would reach from New York to Pittsburg, a distance of 438.76 miles. This output of 200,000 is three times greater than that of 1907, considered from this linear standpoint, for the automobiles of 1907, had they been placed end to end, would have extended from New York to Harrisburg, a distance of 191.95 miles. Compared with this, the 13,333 automobiles manufactured in 1903 seem exceedingly small, although as a matter of fact the machines for that year, had they been placed end to end, would have extended from New York to New Brunswick, N. J., a distance of 29.25 miles. Even this, small as it seems in comparison with the gigantic production of 1910, is huge when we consider that between 1895 and 1899 the 670 automobiles produced in this country would have extended only from New York to Jersey City, a distance of 1.46 miles.

Had all the automobiles made in 1910 been converted into a single huge machine, the result would be, as our front-page illustration shows, a car which would be longer than the steamship "St. Paul," measuring 554 feet from stem to stern. Even the output of 1899, had it been thus converted into a single machine, would have been longer than the "St. Paul." The machines of 1903 similarly considered would have been three-quarters as long. The output of 1895-1899 is, of course, vanishingly small in comparison with this gigantic trans-Atlantic steamer.

Naturally an industry of such Titanic proportions must be capitalized at millions. On the whole, it is safe to say that the actual capitalization of the automobile manufacturers is about $250,000,000. The output for 1910 alone will surely exceed 200,000 cars. Even now there are over 150,000 automobiles in use throughout the country. The actual number of employés in the industry is 125,000 in motor-car factories, with employés in parts factories reaching not less than 40,000, a total of 165,000.

Hand in hand with this increase in money value, we find improvements in manufacturing processes. Five years ago, where a man would have paid from $2,000 to $2,500 for a touring car, or $650 to $1,200 for a runabout, he scarcely expected to get much in the way of durability, or if he did, in the exuberance of unsophisticated anticipation, he was almost sure to be disappointed before he had used the car many days. When we recorded the automobile runs of those days, in these columns, we usually had to recite a series of troubles of various sorts, chiefly with tires, carbureters, ignition devices, as well as breakages and imperfect functioning of valve mechanisms, shafts, gears, chains, steering knuckles, driving axles, and other vital parts. Contrasting this condition with the results of the Glidden Tour of 1909, we find that thirty cars took part in that run and finished an arduous trip of 2,640 miles in 15 days, at an average speed of twenty miles an hour during the daylight running periods, without making a single involuntary stop. That tells the tale of the wonderful technical improvements which have been effected in the brief space of a few years. It is rarely indeed that repairs are made during runs nowadays. Occasionally a brake, a carbureter, an ignition system, may have to be adjusted, or a tire may blow out, but the cars operate smoothly and trustworthily.

The introduction of special grades of steel, aluminium, vanadium, and babbitt, all of them endowed with definite physical properties peculiarly suited to the requirements of automobile manufacture, have wonderfully improved the quality of the motor car. Nickel steel and chrome-nickel steel are now used in crank shafts, transmission shafts, driving axles, driving and differential steering gears, steering knuckles, and similar parts; manganese-bronze, phosphor-bronze, and various aluminium alloys find their places in crankcases, gear boxes, steering-gear housings, and parts demanding great stiffness combined with light weight.

The automobile industry is very largely responsible for the discovery of the physical properties of chrome-nickel steel and vanadium-chrome steel under different modes of heat treatment and for the introduction of special tool steels required to work them, and has thus indirectly benefited the metallurgical industry of this country. As a result of the employment of these new steels in the sliding gear sets, by way of illustration, it is now possible to transmit the 40 and 60 horsepower of the modern touring car with smaller and lighter gear sets than were used in cars of 12, 15 and 20 horse-power five years ago, and that with much greater certainty against breakage and the practical elimination of the mangling of the ends of the teeth by meshing and of wear due to contact under load. All this improvement in quality, plus infinitely more grace in general lines and in comfort to the passengers, is offered to the buyer almost at no advance in cost over the ungainly, uncomfortable, and poorly-equipped cars of six and seven years ago. It is safe to say that a great proportion of the automobiles manufactured in 1910 will be low-priced cars. The car that could be bought a few years ago by the man of moderate income required close attention. Automobiling at that time was unquestionably a diversion for the rich. Nowadays a man of moderate means can purchase and use a car at an expense that is well within the bounds of reason.

In the early days of the automobile industry, the manufacturer was under the necessity of making all his parts; to-day the factories actually making even 75 per cent of the parts that they use are in small proportion to the number of producers. It is to these changes that the excellence of the medium-priced automobile is largely due. There was a time when an assembled car was undoubtedly open to suspicion; for however desirous a maker of its parts might be to do good work, he had neither the knowledge nor the facilities that would make it possible. These same companies now possesses enormous plants. Their designers and equipment are the best obtainable, and their products embody the latest and best in practice, workmanship, and material. Assemblers now have at their command parts of a high degree of excellence, and can buy them at prices far below those charged for the weak and faulty product of former years.

When a manufacturer turns out twenty thousand cars a year, it is not only justifiable but necessary for him to invest very considerable sums in special machinery of all kinds that for a smaller output would be inadvisable. One manufacturer has spent $40,000 for dies to produce a rear axle housing; on a production of one thousand cars, the charge against each for this would be $40. With an output of twenty thousand cars, however, the charge of $2 against each is little enough for the purchaser to pay for so excellent a feature.

A recent development that illustrates the endeavor to reduce manufacturing costs is the establishment by some of the leading producers of assembling shops at the large centers. To these are shipped parts in sufficient quantity to build the cars required for that locality, and as there is no equipment of machine tools, the expense is slight. The freight rate on unassembled parts is much lower than on complete cars, and the saving effected in time and convenience as well as in money makes the system a satisfactory one.

Vast as the automobile industry is, huge as is the value of its output, it must not be supposed that the profits are illegitimate. It is safe to say that the present-day manufacturer of medium-priced cars makes no more than a legitimate profit. One of the largest producers stated recently that his profit on a $1,000 car is less than $100; surely not excessive when one considers his enormous investment in material and parts, his really vast equipment of machine tools, and his labor expense.

It has been said that any average engineer can design a car to sell at $4,000, but that the greatest skill is necessary when the selling price is to be less than $1,000. Perhaps that may account for some of the exceedingly clever designing in the low-priced cars.

The scene of the industry has shifted in the years from 1895 to 1910. Much of the early experimenting in motor cars and early manufacturing was done in Buffalo, Tarrytown, Marion, N. J., Bridgeport and Hartford, Conn., Philadelphia, Pa., and other Eastern States. At present Michigan leads all the States in motor-car manufacturing, for that State last year made 112,000 of the total production of cars for 1909. Four other States adjoining it will produce 75,075 machines at least. The Middle West may therefore be said to be the real home of the automobile industry at the present time. It controls not only the car-making industry, but the making of tires, parts, and accessories as well, a condition which is primarily due to the industrial enterprise of the smaller communities of the Middle West, who have given land and in every way furthered the making of automobiles. It must also be considered that the makers of automatic machinery are very largely situated in the West, for which reason the better class of skilled labor is there to be found. Lastly, the shifting of the industry from the East to the Middle West has been caused in part at least by the fact that the raw material is there put through its first and second processes, as in the case of rubber, steel, leather, wood, brass, and the like.

That the Middle West is undoubtedly benefited by the influx of automobile manufacturers can be shown by the wonderful increase in the population of some of the smaller towns. The influx of 2,000 to 5,000 families has doubled and trebled the populations of such cities as Flint, Mich., and Newcastle, Ind., and greatly enhanced the value of real estate. Towns which were practically unheard of before the automobile entered into our daily life are now thriving centers of industry. Communities with a population of only five or six thousand have their names brought home through the magazine advertising pages to millions and millions of readers, simply because they are the sites of large automobile plants.

Cost of Various Methods of Illumination.

The Frankfurter Zeitung publishes the following remarkably complete table of the cost of various methods of illumination:

	Cost of 100 normal candle hours. Cents.
Washington light	0.238
Flaming electric arc	0.381
Mercury vapor lamp	0.595
Incandescent gas light	0.595
Incandescent petroleum light	0.714
Direct current electric arc	0.942
Osram, zircon and tungsten lamp	1.190
Kerosene burner	1.666
Osmium lamp	1.785
Tantalum lamp	1.904
Incandescent alcohol lamp	1.904
Alternating current electric arc	1.904
Nernst lamp	2.023
Small arc lamps	2.142
Acetylene	2.856
Carbon filament	3.808
Argand gas burner	3.808
Fishtail gas burner	5.950
Stearin candle	26.180

The Washington lamp is an incandescent lamp which burns petroleum under pressure.

In compiling this table the following average prices for fuels and electrical energy have been employed:

Kerosene ..... 2.38 cents per pound.
Alcohol ..... 4.33 cents per pound.
Stearin candles .. 16.23 cents per pound.
Gas ..... 107.87 cents per thousand cubic feet.
Acetylene ..... 809.07 cents per thousand cubic feet.
Electric energy 11.90 cents per kilowatt hour.

According to plans formulated by Rear-Admiral Cowles, chief of the Bureau of Equipment of the United States navy, and submitted by him to Congress, wireless apparatus of the latest type is to be supplied to all the new vessels of the navy, including destroyers and all auxiliaries, as this latter class of vessel has proved very valuable in establishing wireless chains across long stretches of ocean without the necessity of disrupting the fighting fleet. Another shore station is contemplated at Dutch Harbor, Alaska, to provide wireless communication to Bering Sea, connecting with the Cape Nome station, permitting vessels from Nome to lower California to keep in touch with the world. After the contemplated high-powered station in Washington has been completed it is believed similar stations will be found necessary in the following places: The west coast of the United States, the Panama Canal Zone, Hawaii, and the Philippines. With stations at these places vessels will be within call while in practically all waters where naval operations of interest to the United States might be expected. Each station will cost $100,000.

Correspondence.

PFITZNER'S MONOPLANE.

To the Editor of the SCIENTIFIC AMERICAN:

I have just read with much interest an article in your issue of February 12th under the caption "A Novel American Aeroplane."

The monoplane has always appealed to me as being more consistent with the laws of nature, and therefore more susceptible of continued improvement and eventual perfection, than the biplane. The double or triple planes strike me as being contrary to the examples set us by Nature, the extra planes being a superfluity of which Dame Nature is rarely, if ever, guilty. It would be an incongruity for a bird to be supplied with more than one pair of wings, unless the duplex or triplex wings were accompanied by a Siamese-twin or triplicate body. As long as there is but one body and one source of motive and controlling power, a single pair of supporting planes would appear to be all that is necessary if the planes are sufficiently extended to support the body at the speed normal to the bird. Additional planes do not sufficiently compensate by their increased buoyancy for the increased weight, unwieldiness, and instability. I therefore pin my faith to the monoplane as likely to afford an additional illustration of the truth of the Darwinian theory of "the survival of the fittest."

Mr. Pfitzner's design, according to my ideas, comes nearer to the ideal heavier-than-air flying machine than anything that has heretofore been brought to my attention. I will be greatly mistaken, and disappointed as well, if we do not hear from his machine ere long as successfully rivaling even the best of the biplanes.

But even Mr. Pfitzner's novel design is susceptible of improvement. I cannot help wondering why neither he, nor any other aviator as far as I have been able to observe, has adopted what I consider to be a very essential element of stability invariably to be found in the make-up of the denizens of the air. I mean the invariable disposition of the weight of the body to the supporting planes. Mr. Pfitzner seems to have entirely ignored this principle, like all other aviators, by placing his engine and driver's seat above or on a level with the supporting planes.

Nature, on the contrary, suspends nearly the entire weight of the bird below the level of the wings or planes, evidently for the express purpose of securing stability. During flight, or particularly while soaring, the extended wings of the buzzard (to adopt a familiar example) are held in a plane slightly above the point of their juncture with the body, while at the same time the head is lowered and extended forward, so as to bring it down to or beneath the plane of the wings. While the bird is sailing in a calm atmosphere, the legs and feet are drawn up toward the body; but let a sudden gust of wind strike under one wing and tend to displace the center of gravity, the legs are at once extended in order to lower the center of gravity, and equilibrium is at once restored. This seems to me to be a wise provision of Nature, worthy of imitation as far as is practicable by the aviator.

With the engine, and naphtha and water tanks, as well as the seat of the aviator, rigidly suspended as far as conveniently possible below the planes, the weight acts like a pendulum, the plumb-bob of the mason, or the ballast of a ship; its constant tendency being to restore the equilibrium of the planes the moment the disturbing force is removed. And in making a change of direction, if the radius of the curve is abrupt, the tendency of the outer plane to rise on account of its increased speed as compared to the retarded speed of the inner plane will be measurably counteracted. With the weights so disposed, the extended planes will act like a parachute, and in case of the sudden breakdown of the engine or propeller would, in conjunction with the usual downward glide of the machine, enable the aviator to alight in an open space "right side up," without damage to either himself or his aeroplane.

Were Mr. Pfitzner to raise his planes to the tops of the vertical posts, and lower the engine, tanks, and seat to a level with the axles of the carriage, he would find that much less skill would be required to preserve the equilibrium of the machine. Possibly the propeller shaft should remain on a level with the planes; but if lowered just far enough to enable the blades to clear the ground, I apprehend he would be able to make a quicker start. The tendency to drive the plane upward would assist it in leaving the ground, and, once afloat, that tendency, if persisted in, could readily be counteracted by the proper use of the forward horizontal rudder, without perceptibly impeding the speed of the flyer.

I would suggest another scheme for the rudders. Let them be connected together, so they would move in unison. When the horizontal rudder is elevated or depressed in order to rise or descend, it would make no material difference if the perpendicular rudder did also rise and fall in a perpendicular plane. It would produce no change in the direction. In like manner, if the perpendicular rudder should be turned to the right or left in order to alter the course, it would have no influence on the elevation of the machine.

I possess but a superficial knowledge of aviation, and I have no means for investigation or experiment, but I have been intensely interested in the science ever since the Wrights' experiments were first made public. The above thoughts came to me as I read and pondered the description of Mr. Pfitzner's novel device. I make bold to offer them to you for publication if you deem them worthy of being embalmed in print.

Norfolk, Va. C. E. MCCLUER.

THAT NUMBER PUZZLE.

To the Editor of the SCIENTIFIC AMERICAN:

If your correspondent in the issue of January 22nd will study the following figures, he will plainly see that it is *not* impossible to get 35 sets of 3 out of 1—15, so that no two numbers will be in the same set more than once:

1— 2— 3	2— 4—10	3— 6—11	4— 9—12	6— 9—13
1— 4— 6	2— 5—11	2— 7—12	4—13—14	6—10—14
1— 5— 8	2— 6—12	3— 8—13	5— 6— 7	7— 8— 9
1— 7—10	2— 7—13	3— 9—14	5— 9—10	7—11—14
1—12—14	2— 9—15	4— 7—15	5—14—15	10—11—13
1— 9—11	2— 8—14	3—10—15	5—12—13	8—10—12
1—13—15	3— 4— 5	4— 8—11	6— 8—15	11—12—15
1— 2— 3	2— 4— 6	3— 5— 6	4—10—14	6— 9—12
1— 4— 5	2— 5— 7	3— 8—11	4—11—15	6—10—15
1— 6— 7	2— 8—10	3— 9—10	5— 8—14	6—11—14
1— 8— 9	2— 9—11	3—12—15	5— 9—15	7— 8—15
1—10—11	2—12—14	3—13—14	5—10—12	7— 9—14
1—12—13	2—13—15	4— 8—12	5—11—13	7—10—13
1—14—15	3— 4— 7	4— 9—13	6— 8—13	7—11—12

If he will carefully inspect the 30 sets of numbers presented by him in the same issue, he will discover that the numbers 4 and 6 are twice paired, leaving only 29 sets without duplicates.

Milwaukee, Wis. LEWIS SHERMAN.

REBUILDING THE "IDAHO" AND "MISSISSIPPI."

To the Editor of the SCIENTIFIC AMERICAN:

As one of your readers, I have been following with interest the proposals put forward by various gentlemen regarding the reconstructing and rearming of the different types of pre-dreadnought battleships in our navy.

In the March 5th number of your paper you published a letter from Mr. W. W. Bass concerning a proposed rebuilding of the battleships "Idaho" and "Mississippi" so as to make them nearly equal to the "Louisiana" class. One of the objections put forward was the impossibility of establishing a 10-inch gun in a turret built for two 8-inch. Why not avoid this difficulty by leaving the eight 8-inch guns already mounted where they are and then to increase as much as possible the 7-inch battery below? This would make these ships even more similar to the "Louisiana."

I do not believe that the cutting in two of a battleship would entail very great difficulties; as, a few years ago, a White Star liner was cut in two and a new bow built on, the original having been destroyed by an accident. A torpedo-boat destroyer of the British navy also was rebuilt in this manner.

But if it was deemed too expensive to build this section as proposed, would it not be feasible to sacrifice a few 7-inch guns and re-engine the ships with turbines of greater power, thus attaining the extra knot and a half necessary to bring them up to the "Louisiana's" speed standard without the cost, time, and labor of totally rebuilding them?

LEONARD OPDYCKE.

New York, March 21, 1910.

[The "Idaho" and "Mississippi" are so much shorter than the "Connecticut" that there would be no room for the mounting of additional 7-inch guns. It would be useless to install turbines in these ships without increasing their length, and the cost of both changes would not be warranted by the advantages of additional 7-inch guns and the greater speed secured thereby. The deficiencies in these ships are due to the action of Congress in limiting the displacement to 13,000 tons.—ED.]

Death of Alexander Agassiz.

Prof. Alexander Agassiz died on the steamer "Adriatic" on March 29th, while on his way to New York. Hardly less famous as a scientist than his father, he was noted not only as a biologist but as a mining engineer, financier, teacher, and man of the world. In his life he combined the activities of president of the Calumet and Hecla Mining Company and director of the Museum of Comparative Zoology at Harvard, founded by his father. Prof. Agassiz was born in Neuchatel in 1835, and did not come to this country until he was fifteen. His early education was received in Europe, although he was graduated from Harvard with the class of 1855. He started out in life as a civil engineer, and did much valuable work as assistant on the Atlantic Geodetic Coast Survey. His work in that field naturally drew his attention to the natural sciences. He began to collect fishes for his father, and thus was induced to follow in his father's footsteps. After that his activities were almost equally divided between zoology and mining.

A study of the copper mines of Peru and Chili led him to a survey of Lake Titicaca, and also to collect Peruvian relics, which are now lodged in the Peabody Museum at Harvard. Five years of his life, from 1876 to 1881, he spent in deep-sea dredging. His biological survey of the waters of the Gulf of Mexico and the Caribbean Sea is still regarded as classic.

His exploitation of the Calumet and Hecla mines to his profit secured the means to gratify his father's ambition, the erection of the great Harvard Museum of Comparative Zoology.

He made by his persistence and ability in argument the development of the Lake Superior copper territory on Keweenaw Point (and now later traced to the mainland) a certainty.

Death of Hermann Moedebeck.

Oberstleutnant z. D. Hermann Moedebeck died recently. With him there has passed away one of the most ardent advocates of aero-navigation. Thanks to his efforts the Deutsche Verein fuer Luftschiffahrt included in its programme meteorological measurements. As a young lieutenant, Moedebeck became a member of the Deutsche Verein zur Förderung der Luftschiffahrt. As a captain he founded in Strasburg the Oberrheinische Verein fuer Luftschiffahrt, and published its official organ, Illustrirte Aeronautische Mitteilungen, now the official organ of all the German aeronautic societies. In 1907 Moedebeck was promoted to Oberstleutnant. A year later he retired from active army service in order to devote his entire time to aeronautics. He was a member of the International Commission for Scientific Aeronautics and a charter member of the International Commission of Aeronautic Maps. It was only recently that he founded an aero Luftflottenverein fuer Berlin und Brandenburg.

Death of Galen Clark.

Galen Clark, who died in Oakland, Cal., on March 24th, had been known for the last half century to almost every tourist who has visited the Yosemite Valley. While on a hunting trip in 1857, he discovered the great redwood grove at Mariposa. Soon after that Clark devoted much of his time to exploring the upper heights of the Sierra Nevada Mountains, and made known to the world much of the beauties and wonders of the big tree groves and of Yosemite.

The Current Supplement.

In the current SUPPLEMENT, No. 1788, Mr. P. M'N. Bennie reviews the recent work which has been done in the electrical reduction of iron and steel. There is much confusion with regard to dyestuffs and the colors which they impart to the textile fabric, and this confusion Prof. Otto N. Witt seeks to remove. Some very interesting novelties in toys are described and illustrated. Lieut. John C. Solely exhaustively discusses the oil fields of the Gulf of Mexico. In an article on the South Pole will be found mentioned the various schemes which have recently been put forth to reach the South Pole. Prof. George E. Hale's admirable consideration of solar vortices and magnetic fields, in which he reviews his recent study of the sun, is concluded. Halley's comet is now visible to the naked eye just before dawn in the eastern sky, for which reason Mr. George F. Chambers's most thorough article on this interesting wanderer is published with peculiar timeliness. One of the most important articles in the SUPPLEMENT is Mr. Aston's account of the recent Olympia aero exhibition, by far the biggest of its kind which has ever been held in Europe.

According to the Engineering Record improved boiler performance has been attained at the Anderson station of the Indiana Union Traction Company by preventing the leakage of air from the ashpits around the ends of the chain grates into the flues. This is accomplished by first fixing a 4-inch extra-heavy pipe across the furnace 8 inches from the rear of the grate, with its lower surface 3½ inches above the top of the grate. There is a span of about 10 inches between the center of the pipe and the rear fire-box wall, which is covered with a course of fire-brick. This shelf prevents the passage of air, while the pipe holds back unconsumed coal until it has been burned into ash, which the grate can carry back under the pipe in the desired manner. Inside the 4-inch pipe is one of 1 inch diameter running from one end nearly to the other. Cold water is admitted through the small pipe and flows back through the large one, the rate of flow being adjusted so that its final temperature is just under the boiling point. The hot water is discharged, in a way that permits its condition to be inspected, into a header delivering it to the hot well.

OUR SEACOAST DEFENSES

BY CAPT. H. E. CLOKE, U. S. ARMY

When the Constitution of the United States was framed, creating a republican form of government, provisions were made for the creation of military and naval forces and for the existence of State troops for the purpose of repelling of invasion.

Owing to the fact that access to our coast fortifications has in years past been prohibited to the citizens of this country, it is not surprising how few men understand the method of firing a high-powered gun or a modern mortar. For this reason the following description, illustrated by the different drawings, is given.

Let us consider the enemy's fleet to have been sighted on the horizon, and headed under full steam in column formation for the entrance of a harbor. The attack is being made during a late hour of the night. On the discovery of the leading ship by the powerful searchlights of the defense, the battle commander directs the sounding of "call to arms." Within ten seconds every soldier is at his station or post for duty; for in case of imminent attack, the men sleep at the guns. The battle commander then notifies the fire commanders by telephone of the approach of the fleet. The fleet would probably be picked up at ten or twelve thousand yards. At this range all the heavy batteries, including mortars, are directed on the leading ship. The probability of hitting her by this means would of course be greater than if the fire were dispersed. All guns attack the side armor and turrets of a battleship, while the mortars attack the decks. The searchlights of the different fire commands are now concentrated on the leading ship, while the battle command lights are searching for undiscovered ships.

It has been found in practice that this type of disappearing gun is a "rapid-fire gun." It can actually be fired more rapidly than the 6-inch "barbette type." This gun has scored 100 per cent of hits at 6,000 yards range several times.

Positions of detachment at command "Load" for 6-inch disappearing rifle.

The range finder is the eye of the system, while the telephone and telantograph are its nerves. The hitting power of a battery absolutely depends upon its range finder.

A range-finding room. (B' station.)

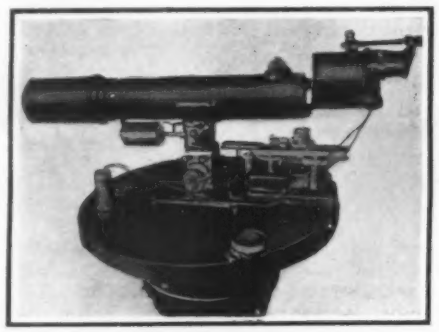
In order to fire a modern 12-inch gun, the following data must be accurately determined:

The elevation to be given to the gun (which is a direct function of the range) and the amount of deflection to be set on the sight. If the gun were merely set for the range from the gun to the target, the probability of hitting would be very small. The errors that enter into the range function are as follows: 1. The accelerating or retarding component of the wind. 2. The variation of the height of the gun above water level, due to the height of tide. 3. The variation of the resistance offered by the air, due to its density. 4. The variation of the initial velocity of the powder, due to temperature or other causes. 5. The change of the range, due to the speed of the target. These corrections must be applied to the range with lightning rapidity. It is accomplished by the use of certain mechanical contrivances, which are located in the various fire control stations of the fortress.

The deflection correction to be set on the sight is the algebraic sum of the component of the wind, the drift, and the speed of the target, and it is determined by means of mechanical devices located in the plotting rooms. The following, then, would be the method of determining the range and deflection to be sent to the guns by telautograph or telephone: At the simultaneous ringing of the bell in the primary

No better service could be rendered to the country, and there is no service that should appeal more to the patriotism of our State troops, than this, and particularly the troops of those States which border the coast to be defended. Our organized State militia and the various labor organizations should be attracted to the subject of coast defense for the reason that men in such organizations are unable to leave their families and business interests and enlist for general service in time of war. If they were organized as a defensive force for the protection of their homes against invasion, the defensive forces of the State and country would be increased by a body of men of a high order of patriotism and intelligence.

When one contemplates the cost, our coast defenses certainly do appear to be an expensive investment. For example, a 12-inch gun, complete, costs about $145,000; and as there are about one hundred of these guns mounted in our coast forts, the cost of the 12-inch guns alone amounts to $15,000,000. On the other hand, we must remember that this sum does not equal the cost of two "Dreadnoughts." It costs about $600 every time one of these guns is fired with an armor-piercing explosive shell; but one of these shells, if directed at the proper point on a modern battleship, will inflict hundreds of thousands of dollars worth of damage. Although one submarine mine, charged with a hundred pounds of nitro-glycerine, costs about $500, it may, if exploded underneath a battleship, send many millions of dollars to the bottom of the sea. On the other hand, the life of the 12-inch guns, without refiling, is only about 240 pounds; that is to say, firing one shot every thirty seconds (the time of fire of a 12-inch rifle), the gun becomes useless after a two-hour engagement.

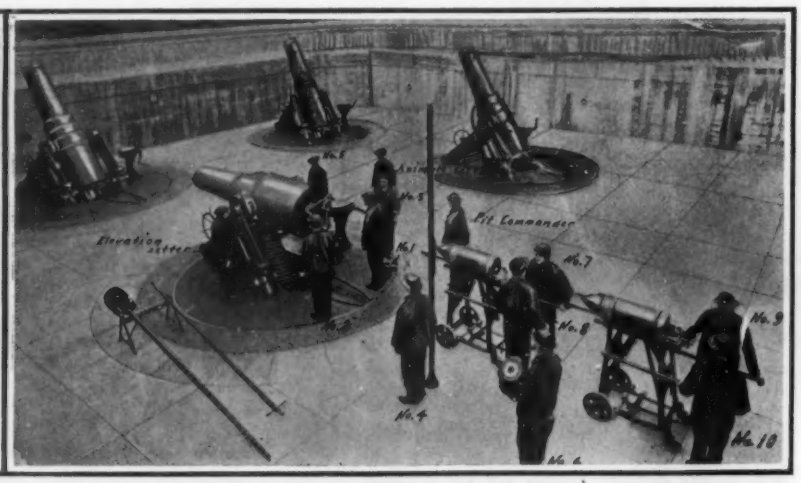


Inside the telescope of this instrument are vertical and horizontal cross hairs. As the eyepiece of the telescope is elevated or depressed in waterlining a ship, certain gears underneath the base plate move a pointer on a disk which is graduated to yards of range. The operation of intersecting the horizontal cross hair with the waterline of a ship, therefore, determines the range automatically. This instrument is the invention of Major Lewis of the coast artillery corps.

Lewis position finder.

It is in this room that specially trained men determine, from data received from the range finders, the course of a target and its predicted position. This "predicted range" is sent to the guns of a battery and by the ring of a bell the "predicted time" is announced and the gunner fires by an electric pistol device.

A plotting device.



These weapons attack the most vulnerable part of a ship—the decks. Each one is loaded with a 1,000-pound shell which is filled with about 100 pounds of high explosive which detonates on striking. Sixteen of these mortars are fired at once. Their extreme range is 12,000 yards. At long ranges they are more accurate than guns.

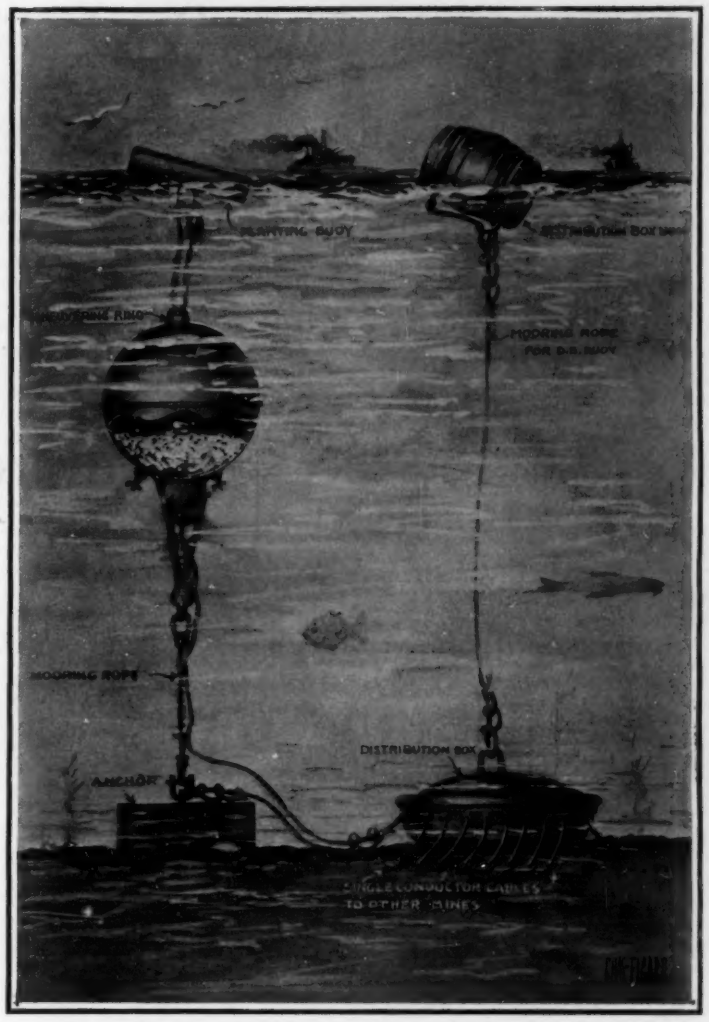
Positions of detachment at command "Posts" for 12-inch mortars.

and secondary stations, the observers at the instruments read the azimuth angles at the base ends. These angles are immediately plotted on the plotting board, and the position of the target with reference to the center of the gun is determined. At the expiration of 15 seconds, the bell again rings, and the target is again plotted. The course of the ship is then accurately determined and, by means of a mechanical device on the gun arm, the amount the target has changed in azimuth, due to its speed, is determined. The last range read is now set on a device called the range board. This device is practically a graphic adding and subtracting machine. The corrections above referred to for atmosphere, wind, tide, etc., are here applied, and the resultant correction (a reference number) is set off on the gun arm of the plotting board, and corrected ranges are now sent to the gun by telephone or telautograph. This range is called the corrected, predicted range to the target. It is predicted for an interval of 15 or 30 seconds ahead. It is now plugged in on the time range relation board, which is in full view of the range keeper at the gun. The range keeper keeps the range disk continually set at the corrected range (as observed on the time range relation board) such that the gun can be fired at any time. The deflection correction is obtained by the use of a device called the deflection board. This, as in the case of the range board, is an adding and subtracting machine which determines the number of degrees and minutes of deflection to be set on the sight due to wind, drift, and speed of target. The drift is determined by ballistic calculations, and the curve is constructed on a metal leaf on the board. The velocity of the wind is determined at the meteorological station by means of an anemometer, and is received at the plotting room by means of an electrical device called the aeroscope, shown in the drawing. The azimuth of the wind is also sent by the same means. The components in the direction of range and deflection are determined by means of a device called the wind component indicator, shown in the picture. The atmosphere correction is determined in the meteorological station, and is sent in over the aeroscope. The height of tide is determined by a tide gage. The velocity correction is determined by a device called the powder chart.

Owing to the fact that these corrections may be either additive or subtractive, and that the use therefore of a negative sign tends to confuse the gunners in the plotting room, these corrections to be applied to the range are not sent in according to their actual values, but by means of reference numbers. The zero of the sight, for example, is the number 3. The gunner at the sight, therefore, would receive a deflection like this: 4.25. He simply sets his sight to read this deflection, and the gun will then be correctly aimed. It is to be understood that all these fire control instruments and stations are located at obscure places in the fort reservation, and are amply protected by parapets of earth and concrete. They are connected with each other by either telephone, telautograph, or speaking tube, all of which are laid underground, deep enough to insure ample protection from ordinary gun fire.

The fire control system of our coast artillery is also very flexible. If the horizontal base system fails, each observing instrument at the primary and secondary stations can be used as a vertical base range finder; and the system is so arranged, that in case all the range finders except that of the fire commander are put out of action, his station can supply all the guns with the necessary data for firing them. Furthermore, if all the stations, including the fire commander's, should be

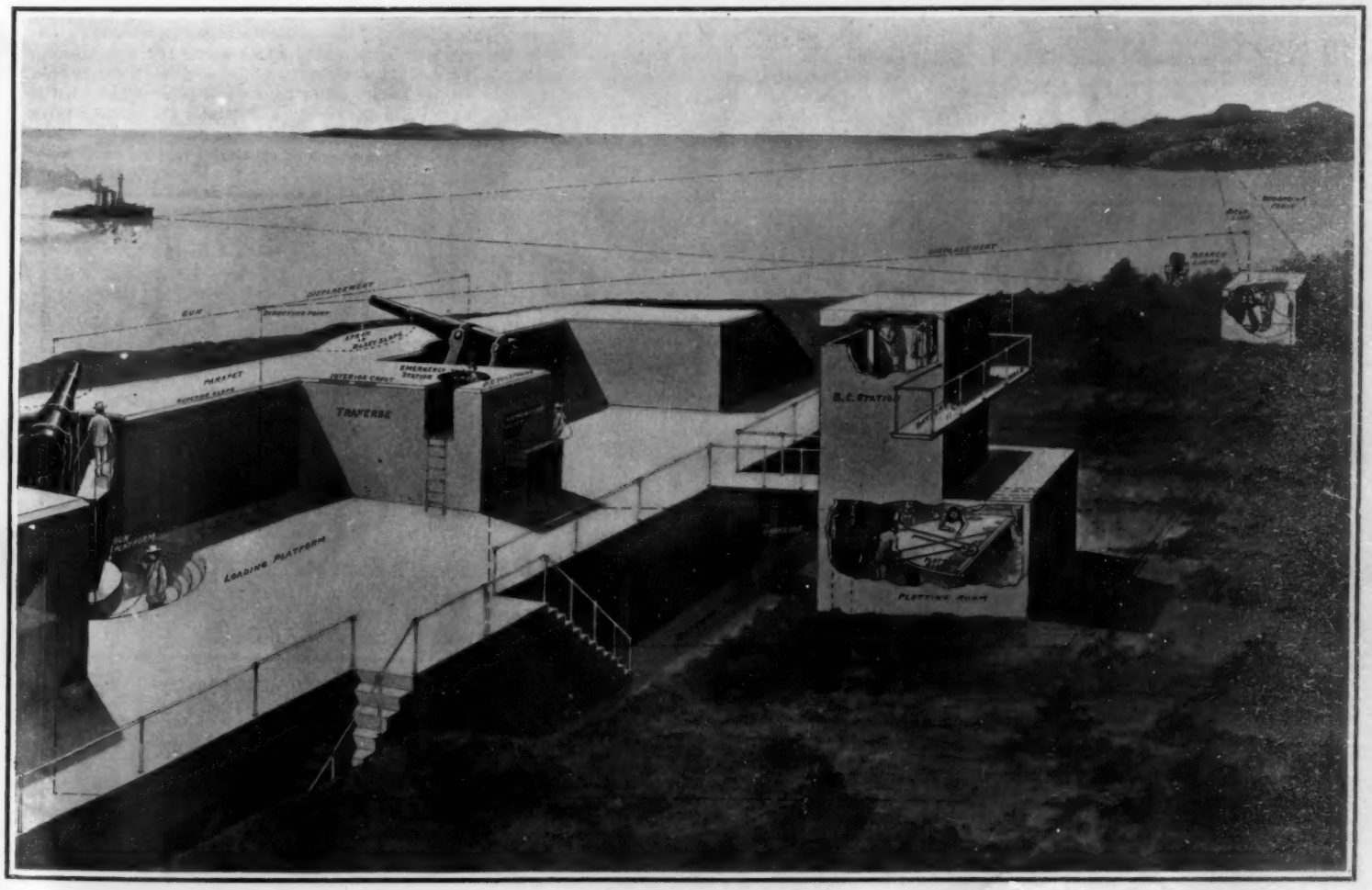
(*Continued on page 306.*)



Groups of these deadly weapons of destruction are planted across channels to keep the enemy out. They are harmless to friendly ships and are entirely controlled from a casemate on the shore. The new system of submarine mining of our army is a great triumph of electrical engineering. The principles of its operation are kept secret. The high explosive is contained in the floating metal sphere.

A complete submarine mine.

(Redrawn from Coke's "The Gunner's Examiner," published by John Wiley & Sons.)



This diagram shows in a general way the arrangement of an up-to-date battery. The position of the enemy is found by observing the angles the ship makes at two observing stations, B^1 and B^2, situated at the end of a common base line of known length. These angles are telephoned to the plotting room where the position of the ship is found. From the plotting room the proper elevation, etc., is telephoned to the gun.

From drawing by Master Gunner Kuhn.

A typical battery command.

OUR SEACOAST DEFENSES.

OUR CIVIL DAY

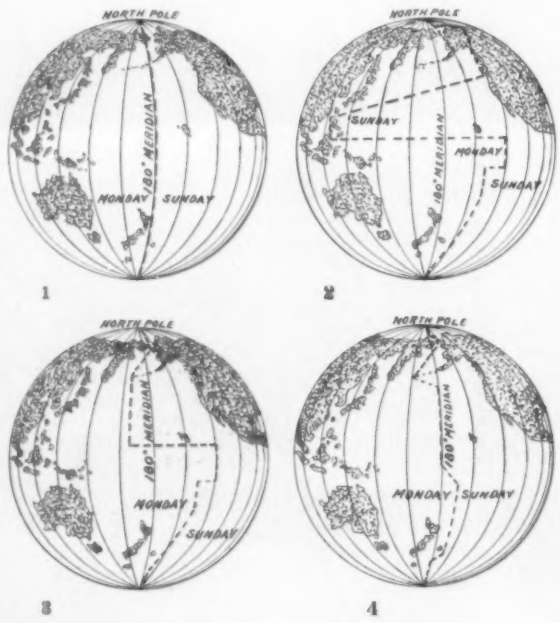
ITS ARRIVAL ON AND PROGRESS AROUND THE EARTH

BY DANIEL ARTHUR

A few generations before our era the "whole known world" was only some 25 million square miles in extent instead of nearly 200 millions as we now know. That great observer and geographer Eratosthenes made a noble attempt about 225 B. C. to draw a map of the "World." He even used lines which looked very like parallels of latitude and circles of longitude. These lines were largely based on the speed records of travelers, and hence were not very accurate. There were no such refinements on his maps as international date lines or time zones. His general outline of the "whole world" was about 90 deg. wide east and west by 60 deg. long north and south. It was all above our equator, and extended only about a quarter of the way around the earth. The mouth of the Ganges was farthest east, and what is now Ireland was farthest west. The Caspian Sea was thought to be an arm of the Northern Ocean, while the lower end of the Red Sea was about the southern limit. Knowledge of the rest of the world grew very slowly then, as was shown by the fact that the great Strabo drew a map of the "World" two hundred years later (about 25 B. C.) and made no material extension of its lines. He pushed Great Britain and Ireland farther west and made some radical changes on the northern edge of the Mediterranean, but otherwise these two maps of two hundred years apart are practically the same. There is very little doubt, however, that Strabo thought the world to be round, before he died. Hence the necessity for a date line was felt even at this early date.

While the spherical earth idea was passing through its hundreds of years of resistance, some radical observers started it spinning on its axis, so to speak. They were bold men, but they proved their case. This brought the date line as a necessity closer to us. It would almost seem that with a "flat disk world" converted into a stationary globe, and later into a rotating globe, the date line idea should have suggested itself at once. Not so, however; for it appears that when Magellan crossed the Atlantic from the east, he passed around South America, crossed the Pacific, discovered the Philippine Islands, and went home around the lower end of Africa, thus completing a trip around the world. This trip was made less than four hundred years ago; yet when the explorers arrived at their home country they were astonished to find that they carried a date on board their ships which was a day earlier than the home date. It was soon found that no mistakes were made on the log books as to the time records, and that the home calendar was certainly correct. The explanation of this seeming impossibility was soon forthcoming, and our date line was born in fact.

As no one wanted the line near his home or country, it was put in the most out-of-the-way place possible, where it still stays. The 180th degree meridian is in theory where each new civil day is born, but in practice it has never been strictly adhered to. Fig. 1, diagram 4, shows its location with the deflections of practice as they now exist on the official map at Washington. This map was made by the Hydrographic Office of the United States to illustrate its replies to a set of questions sent by the writer. The map, together with the questions and the answers, will be found on a recent Pacific chart issued by the Navy Department. To describe the line, commencing at the northern end, it will be seen that the first deflection of practice is to the east, to give the tip of Siberia the same date as the rest of the Russian empire. Then after the line passes through Bering Strait it bears to the west, crossing the true line of 180 deg. and far enough beyond it to take in all of the Aleutian Islands to the American date, after which it turns back to 180 deg., where it stays until it crosses the equator a few degrees, at which point it again deflects eastwardly to give the Tonga Islands the date of Australia. The line then returns to the 180th meridian and continues on that line to the south pole.



1. Theoretical date line. 2. Date line when Alaska took date of Russia and Philippines took d te of Spain. 3. Date line after purchase of Alaska and Philippines took Asiatic date. 4. Present international date line.

Fig. 1.—The evolution of the international date line.

The foregoing is the "international date line" of practice at the present time, but in former generations the deflections were considerably greater, as for example the one shown in the second diagram of Fig. 1. In this date line Alaska was taken into the day of Russia, to which empire it formerly belonged. The line then took a westerly sweep of thousands of miles to take the Philippine Islands under the date as written in Spain. This latter wide deflection was afterward turned back or corrected by the action of the Governor-General of the Philippines when he decreed that December 31st, 1844, be reckoned as January 1st, 1845, to bring those islands into accord with the date of the countries east of the Cape of Good Hope. When Alaska was acquired by the United States, the date line was transferred west of that territory or into Bering Strait. These two radical changes made the line of practice look more like the third diagram in Fig. 1. Refer to Fig. 2, which is intended to show the entrance of time on our globe. The picture illustrates a mechnical delivery of our civil day, month, year, or century by means of an equatorial tape. Let us assume that the earth is stationary and that this tape enters and departs under the date-line rollers as shown. If the tape had a speed of about 1,040 miles per hour and was properly marked in hours, days, months, etc., it would show just how our civil day enters the earth and progresses around it with a constant motion. The illustration shows the front end of the twentieth century as having completed 18 hours of its first day on earth, leaving only 6 hours of the nineteenth century to glide toward the line and off, to no one knows where. The front end of January 2nd will have reached the earth's time door to enter it just as December 31st steps out, as it were. Then we have the twentieth century all over the earth with January 1st reducing its equatorial width at the rate of some 17 miles per minute and January 2nd growing broader at the same velocity. This, of course, is assuming that time is entering normally and not by the arbitrary intermittent steps that we will call the twenty-four way stations of our civil day. This latter system is in successful operation in the United States and two or three other leading nations, China being one of the more recent converts to the hourly zone system.*

Fig. 3 shows the earth with the hourly time belts or zones outlined from pole to pole. The lines drawn are 15 deg. apart and represent the boundary lines of these zones and not their centers. Fig. 4 is the same example as viewed from the north star. In both illustrations the United States are outlined in approximately the correct location, so as to show the theoretical boundary lines of the hourly zones as applied to that country. Now in these two illustrations let us assume that the system has been adopted in all parts of the world. Commencing with the prime meridian at Greenwich as the center of a zone bounded by lines 7½ deg. east and 7½ deg. west, the completion of such a set of lines would give us just what is drawn and what our United States are actually using in theory. To illustrate mechanically the delivery of time on this plan, our equatorial tape is intermittent in its action, that is to say, it jumps 1,040 miles and then stands still for an hour, which means that on the twenty-fourth jump on any day of a given name, that

(*Continued on page 307.*)

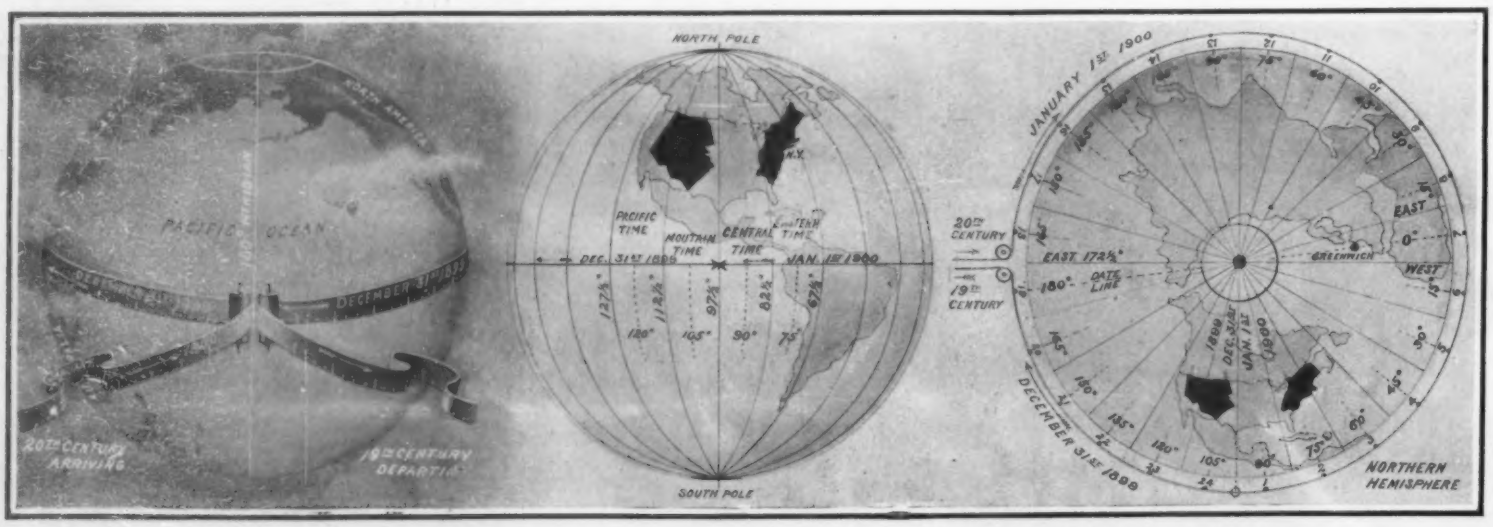


Fig. 2. Fig. 3. Fig. 4.

How the twentieth century was ushered in—a mechanical parallel.

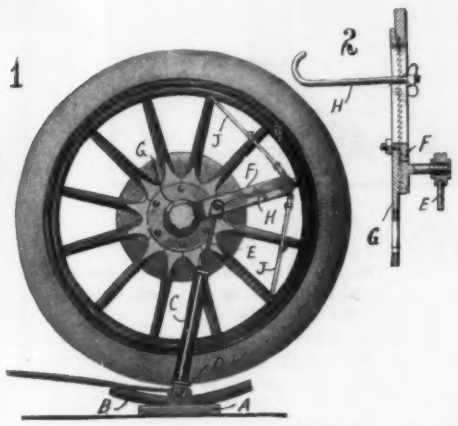
OUR CIVIL DAY—ITS ARRIVAL ON AND PROGRESS AROUND THE EARTH.

*Since writing this article it has come to my notice that Chili of South America has given up local time which was 17 minutes ahead of United States eastern zone and, to quote the Horological Journal, the Chilians were enabled to live the same 17 minutes twice over. The change was accomplished by firing a gun at 12:17 A. M on a given day and calling it midnight. This means that New York city or Washington, D. C., may cable messages to Chili without having to take note of any difference in time.

Patent Department

NOVEL AUTOMOBILE PUMP.

Pictured in the accompanying engraving is an interesting form of pump, that may be used for inflating an automobile tire. The device is arranged to be operated by the automobile itself. It consists of a base *A*, on which is mounted a jack used to raise an automobile axle so that the wheel will clear the ground. The base *A* carries a shoe *B*, which is designed to assist in positioning the automobile wheel with respect to the pumping device before the jack is operated to raise it. The pump is indicated at *C*, and is mounted to rock on a bolt *D*. The pump piston *E* is connected to the automobile wheel by a device shown clearly in the cross-sectional view (Fig.

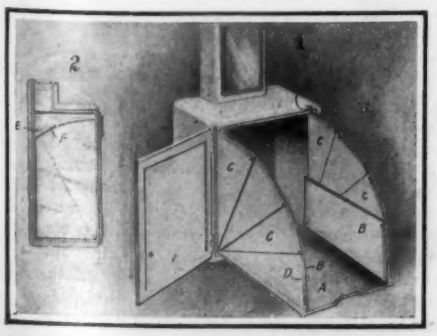


NOVEL AUTOMOBILE PUMP.

2). A slotted plate *F* is provided with teeth adapted to engage similar teeth on a slotted plate *G*. The plate *G* is provided with a crank pin, to which the piston rod *E* is connected. The plate *G* is provided with an apertured extension, adapted to fit over the axle of the automobile wheel. The plate *F* is attached to one of the spokes of the wheel by means of a hook *H*, while a pair of hinged braces *J* are used to connect it with two more spokes of the wheel. In this way a rigid connection with the wheel is secured. By loosening the thumb nut on the hook *H* the plate *F* may be moved up or down on plate *G* so as to adjust the parts to wheels of different sizes. The distance from the crank pin to the center of the wheel, however, is fixed. In use the automobile engine is operated to rotate the wheel, and this action carries the piston up and down in a cylinder, the latter rocking back and forth to accommodate itself to the lateral throw of the crank pin. A flexible tube connect the pump with the tire that is to be inflated. By this arrangement a tire may be inflated very rapidly, and the inflation carried to a further degree than is possible by the manual operation. By using a speed attachment of any of the well-known types, the bursting of tires due to excessive pressure may be avoided. This inventor of this automobile pump is Dr. Richard A. Goeth of San Antonio, Texas.

COLLECTION BOX FOR MAIL CHUTES.

Collection boxes at the termini of mail chutes are frequently filled to such an extent before the mail is removed, that when the collection is made the mail tumbles out of the box on opening the box door and falls to the floor in spite of every precaution taken by the collector. To better this bothersome condition a box has recently been devised which is provided with a platform having foldable side walls that permit the platform to swing downward when the door of the box is opened and serve to prevent the mail matter from falling from the box. The construction of this



COLLECTION BOX FOR MAIL CHUTES.

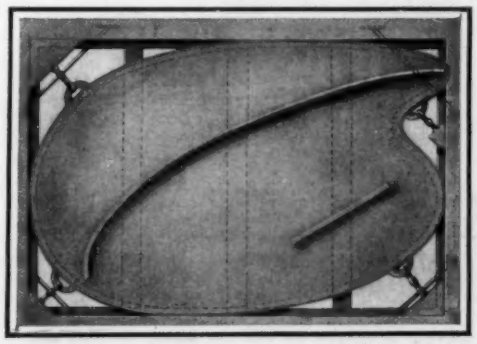
box is clearly shown in the accompanying engraving. Fig. 1 shows the box door open with the platform *A* swung down horizontally. The platform is provided with two side wall plates *B* rigidly secured thereto and a series of sector shaped plates *C*. Near the forward edge of each of the plates *B* and *C* is a groove *D* adapted to receive a pin mounted on the adjacent plate, while at the opposite ends the plates of each side wall are mounted on a common hinge pin. This permits the side walls to close up somewhat after the manner of a fan to the position indicated in Fig. 2. The innermost sector *C* is provided with a lug *E*, which engages a lip formed at the top of the box and limits the outward swing of the platform *A*. To prevent the letters from dropping between the sector plates the top of the box is provided with two guards *F*, which extend below the upper edge of the plates. In use when the platform is lowered the letters in the box will tumble out through the door opening and will be caught by the platform and side walls. The inventor of this collection box for mail chutes is Mr. R. E. Edwards, care of T. J. Kelly, 29 South Eleventh Street, Lincoln, Neb.

A NEW SOUNDING BOARD FOR PIANOS.

The soul of a piano is its sounding board. That sounding board is composed of wood carefully selected and carefully seasoned, so that it will remain constant in quality for the many years during which a piano is used. It is arched or crowned against the pressure of the strings, so that the strings and the sounding board may vibrate in harmony. As the piano ages, the sounding board flattens. In an upright piano this flattening is accompanied by "buckling back" or cracking. The result is that hard, metallic, so-called "tin-panny," tone so characteristic of old pianos. It is obvious that, if some means were provided for permanently arching the sounding board against the pressure of the strings, the piano ought to maintain its tone for years without any tendency of the sounding board to sag.

The attempt has been made frequently. Some success has been attained in grand pianos by the employment of tension rods radiating from a center hub to the sounding-board rim, but so far as we are aware, no one has ever successfully equipped the upright piano with a sounding board so constructed that it would not lose its arch in time. A sounding board of this type which has been successfully applied to an upright piano has recently been invented by Mr. Frank B. Long of Los Angeles, Cal., and is illustrated in the accompanying engraving.

What Mr. Long has done can best be understood



TENSION DEVICE FOR PIANO SOUNDING BOARDS.

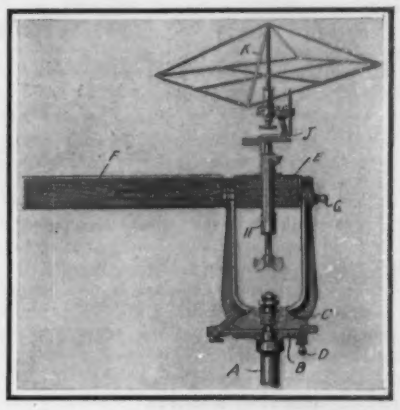
when we consider the true function of the sounding board of a piano. The sounding board serves to sustain and amplify the tone produced when a hammer strikes the strings. Mr. Long has increased the tone sustaining and amplifying quality of the sounding board by flexible reinforcing means interposed between the sounding board and the sounding-board frame, thus equalizing the flexibility of the sounding board and at the same time maintaining its relation to the sounding board frame, so that the greatest possible vitality of the sounding board is insured. From the accompanying illustration, which shows the front of an upright piano with Mr. Long's sounding board in position, it will be observed that the edge of the sounding board is subjected to pressure from screw posts interposed between the edge of the sounding board and the heavy back frame. The pressure is exerted in such a manner as to cause reflection and condensation of sound waves in accordance with the principles suggested by Helmholtz in his work on "Sensation of Sound." Besides creating this reflecting effect, the pressure post serves the additional purpose of maintaining the crowned sounding board in its original form. The back frame supporting the sounding board is reinforced by diagonal tension rods placed across each corner, as shown in the illustration.

The edge of the sounding board is rabbeted and glued into a continuous laminated rim built up of hard maple veneers or layers so as to produce an exceedingly strong construction, which, however, is sufficiently flexible to yield under the pressure posts; with a view to equaling the outward pressure on the sounding board resulting from the stretching of the strings over the surface. By the use of screw pressure-posts, any shrinkage or expansion of the sounding board and the rim can readily be equalized so as to preserve the tone and even to amplify it. The arrangement is such that a proper reflection of the vibrations of the sounding board is obtained, as the strain on the sounding board by the strings is equalized to reflect the tone.

As a result of this new combination of sounding-board rim and pressure posts, a small upright piano can produce a tone which is comparable with that of a small grand piano, and the full round tone of the new upright piano is preserved, because the sounding board is maintained in its original arched position.

EDUCATIONAL APPLIANCES FOR DISPLAYING OBJECTS.

In the instruction of projection, mechanical drawing, descriptive geometry, etc., it is important to be

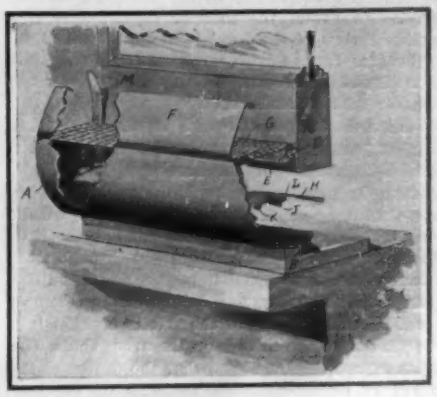


EDUCATIONAL APPLIANCES FOR DISPLAYING OBJECTS.

able to show students a skeleton model of an object, large enough to be seen by an entire class, and which will show front and side elevations, as well as plan and bottom views. Heretofore this has been done by using a glass box within which the object was placed, or by using wire screens for the sides of a box, which permitted the teacher to chalk-mark the outline of the object. An improvement on this system is offered by the invention illustrated herewith. It consists of a stand provided with axes that have automatic stops at quarter revolutions to arrest the model in various positions. The apparatus comprises a vertical shaft *A*, on which is mounted a table *B* that carries a support *C*, provided with a pair of upwardly extending arms. The support *C* has in its lower face four recesses adapted to receive a spring-pressed stop pin *D*. The recesses are positioned at quarter revolutions of the support. Mounted in the arms of the support is a shaft on which are secured the square blocks *E* and *F*. The block *E* is formed with four recesses adapted to receive the pin *G*. The blocks are adapted to receive a clamp *H* that carries the display stand *J*. Model *K* is shown supported on the stand. The display stand may be moved about on three axes, which are fitted with index wheels so as to incline or turn the model about to any desired angle. The inventor of this educational appliance, who is Mr. Hermann Hanstein, of 2019 Mohawk Street, Chicago, Ill., informs us that he has used this display apparatus effectively in his own classes.

IMPROVED DETACHABLE WINDOW VENTILATOR.

The ventilator which is illustrated in the accompanying engraving may be detachably secured to the window casing so that the window may be opened a short distance to permit the entrance and escape of

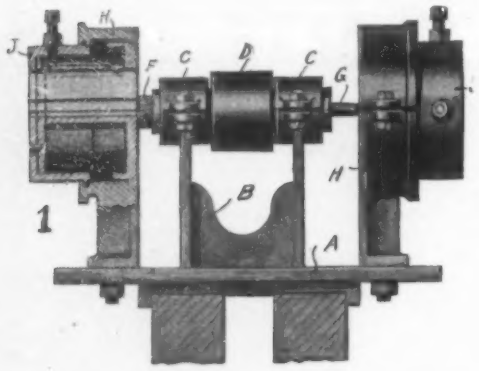


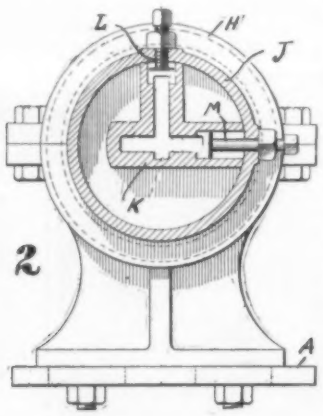
IMPROVED DETACHABLE WINDOW VENTILATOR.

air. Furthermore, the ventilator is provided with an automatic damper, which acts to prevent the entrance of unusually strong currents of air and is fitted with a baffle, which serves to keep out rain or snow. The casing of the ventilator, as indicated at *A*, is quadrant shaped in section, and is fitted into a bracket at each end secured to the window casing. The lower edge of the casing is provided at *D* with a lip that engages the sill of the window. Extending lengthwise of the ventilator is a bar *C*, which is formed of sheet metal bent back upon itself to form a holder for two packing strips, *D* and *E*, which extend in opposite directions. The packing strip *D* is adapted to fit against the sash of the window, while the other strip serves as a buffer for the damper. At the opposite side of casing there is a vertical extension *F*, which serves as a baffle. The screen *G* stretches from the base of this extension to the bar *C*, and serves to keep out foreign bodies that may be drawn into the ventilator by the blast of air. The damper is indicated at *H*, and consists of a plate bent back upon itself at *J* to form a reinforcing bar, while the inner end *K* is weighted so that the damper will normally come to a balance on the axis *L*. When the window is raised the damper swings to the horizontal position as indicated, but if a strong draft blows through the ventilator it will strike the under side of the inner part of the damper, lifting it up until, if the wind is strong enough, it strikes the buffer *E*. When the window is closed it positively closes the damper by bearing against the outer section *H*. The brackets on which the casing is mounted are extensible so as to permit of using a standard length of ventilator with windows of different size. Each bracket is formed with a spring extension *N*, provided with a lug, which is adapted to engage a stop pin on the window sash, and prevent the window from being raised too high. Should it be desired to raise the window further it is a simple matter to withdraw the spring catch *M*. The inventor of this ventilator is Rolla M. Hill, care of the Economy Ventilating Co., Metropolitan Tower, New York.

TENONING MACHINE.

The machine pictured herewith is designed to cut cylindrical tenons on the end of a wooden slat, particularly for use in window blinds. Window blind slats



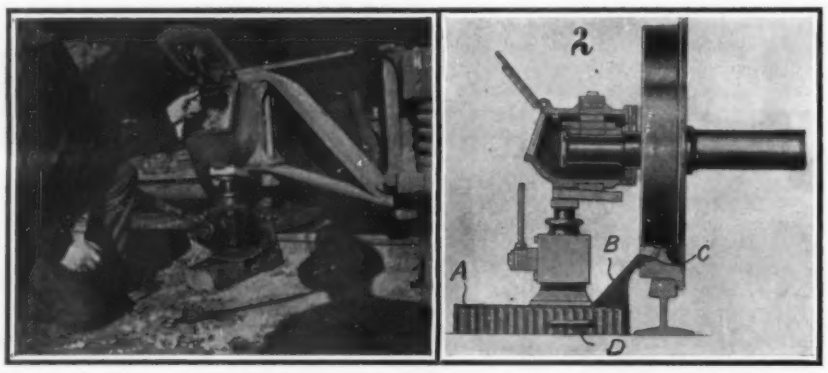


TENONING MACHINE.

usually are provided with a single central tenon, but there is another type in which two tenons are used, and sometimes the slat is provided with three tenons. The machine is designed to form any of these types of slats. It consists of a base *A* provided with a central bracket *B* formed with two bearings *C* in which is mounted an arbor shaft. The arbor shaft is provided with a pulley *D* between the bearings, and may be fitted with tools, such as shown at *F* and *G*, which depend for their form upon the nature of the work which they are to do. Opposite each end of the arbor shaft is a pedestal *H* fitted with a head *J*. In our illustration the head is broken away at the left hand side of the machine to reveal the interior construction. A cross-sectional view of the head is also shown in Fig. 2. The head is formed with an interior web *K*, and the web is formed with a pair of channels that intersect at the center of the head. At the upper end of the vertical channel, and at one end of the horizontal channel is a spring such as shown in Fig. 1, which may be adjusted by means of the screws *L* and *M*, to bear against the work which is placed in the slot. It will be understood that the head *J* is revoluble within the pedestal *H*. The pedestal is connected to the base *A* by means of a pair of bolts which pass through slots in the base plate, thus permitting of a lateral adjustment. In use a slat is inserted in one of the channels in the web *K*, and the end of the slat is brought into contact with one of the cutters on the arbor shaft. The pedestal is adjusted laterally so that the center of the slat is out of alignment with the axis of the tool, and then when the slat is fed against the tool and the head *J* is revolved a circular tenon will be cut in the end of the slat. If a large tool is used all the wood will be cut away except a single tenon, but if a smaller tool is used a central tenon may be cut, leaving enough wood projecting at each end of the slat to form two more tenons. In this way a slat with three tenons can be formed, and by properly choosing the size of the tool and laterally adjusting the pedestal the slat may be formed with two tenons. The inventor of this slat tenoning machine is Mr. José Ojanguren, Calzada del Monte, No. 356, Havana, Cuba.

IMPROVED JACK BLOCK

When the journal bearings or brasses of a railroad car become worn it is necessary to lift the journals by means of jacks so that the brasses may be removed from the car axle, and be replaced with new ones. When operating the jack it sometimes happens that the car wheel is lifted with the journal and derailed. The purpose of the invention illustrated in the accompanying engraving is to provide a device which will hold the wheel down while the journal is being lifted, and form a level surface for the jack to rest upon. The jack block is preferably made of malleable cast iron or steel, and is constructed in the form of a grating with the edges scalloped or corrugated so as to insure lightness without unduly weakening the stucture. At one end the block is provided with an extension *B*, terminating in a toe *C*, which is adapted to fit over the rim of the car wheel. The jack block is rested on one of the sills of the ties of the railroad, and the jack is seated on the upper face of the block, close to the extension *B*. When the journal is jacked up the toe serves to hold the wheel to the rail, relieving the upper journal bearing of the weight of the car and permitting the wedge and brasses to be removed. For convenience in carrying the block about, a handle *D* is arranged at each side of the body of the block, the location being such that the block is balanced when lifted. The inventor of this jack block is Mr. James Allen Gray of Cœur d'Alene, Idaho.



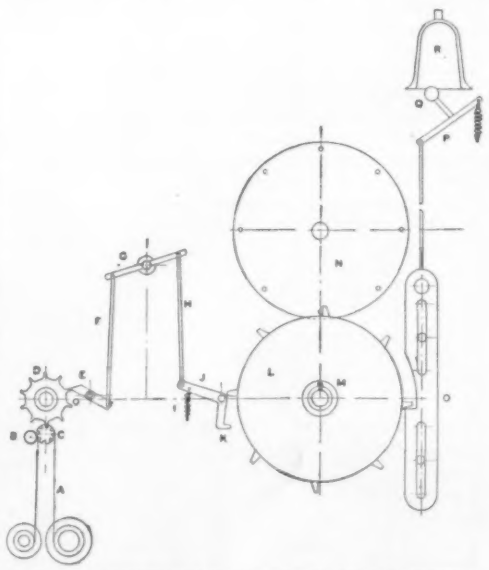
IMPROVED JACK BLOCK.

RINGING CHIMES BY PERFORATED MUSIC SHEETS.

One of the pioneer inventors of the automatic piano player, Mr. John McTammany of New York city, has devised a system of ringing chimes of bells by perforated paper music sheets, such as are employed in piano-playing mechanisms. Mr. McTammany's scheme was evolved as part of a huge memorial to be erected to the memory of the men who fell in the civil war. The memorial assumed the form of a monument in which each State was to place two bells. To ring so extensive a chime by hand would obviously be a task involving superhuman muscular power. Even the present mechanical and electrical methods would probably fail because of their complexity. Hence, Mr. McTammany devised the very ingenious system which is here illustrated.

The perforated music sheet *A* is guided by a roll *B*, and passes over a grooved roll *C*. The pins of a driving wheel *D* are adapted to engage the perforations of the music sheet *A*. The pin wheel *D* is operatively connected by means of a dog *E*, a connecting rod *F*, a rock shaft *G*, a connecting rod *H*, and an angle tripper *JK*, with a primary star wheel *L*, which coacts with the secondary star wheel *N*. The primary and secondary star wheels *L* and *N* are loosely mounted on collars on their respective shafts, and are housed between separators *M* in such a manner as to prevent them from shifting thereon, yet leaving them free to rotate with the shaft whenever it may be necessary for them to do so to ring the bell-ringing mechanism. The star wheel *L* is provided with teeth on its periphery, which teeth are adapted to engage rods projecting from the star wheel *N*, whenever the star wheel *L* is released by the angle tripper *JK*. The teeth of the star wheel *L* engage a slide *O*, connected with a retractile spring-controlled clapper *PQ*, which rings the bell *R*. The several shafts illustrated are geared together in such a manner as to cause the several parts to co-operate in definite order.

A tooth of the wheel *D* having entered a groove of the feed roll *C* through a perforation in the music sheet *A*, the wheel *D* turns on its shaft. In so doing it engages the dog *E*, which in turn through the connecting rods *F* and *H* trips the angle tripper *JK*, thus releasing the secondary star wheel *L*, which, by the friction of its shaft, rotates into engagement with the slide *O*, thereby pulling the slide down and withdrawing the clapper from the bell. When the slide is released by the teeth of the star wheel *L*, the retractile spring of the clapper is released, so that the clapper deals its stroke and rings the bell as the parts return to their normal positions. The wheel *D* straddles the feed roll, and is prevented from rotating except when one of its teeth fits into a perforation of the sheet and into the grooved roll, which turns the primary star wheel one degree.



RINGING CHIMES BY PERFORATED MUSIC SHEETS.

The playing of the bells can be governed by clock mechanism, so as to strike the quarters and the hours and to play airs at stated intervals.

A new form of mercury interrupter has recently been invented in which there are no reciprocating parts, but the interruptions are produced by a ripple formed in a stream of mercury. The mercury is contained in a revolving vessel within which a contact piece is fixed. The mercury is thrown by centrifugal force to the inner periphery of the vessel. At one point the stream of mercury is obliged to pass over a deflector, producing a ripple or wave, and the contact piece dips into the mercury stream at this point as it revolves with the vessel. The frequency of the interruptions may be varied by making the deflector revolve slowly in the same direction as the vessel is revolving, or in the opposite direction, or letting it remain stationary.

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claims for cars; but to make cars that will make good the claims is hard.

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Judged by price alone you might as well buy some other car as a Chalmers: $1500 is simply $1500—no more in one bank than in another, no more in bills than in coin, no more in your pocket than in another man's.

It is only when you begin trying to buy something with your money that the sense of value enters your mind.

Your $1500 is worth more than another man's $1500, if at all, only because you are able to buy more with yours than he can buy with his.

We believe that when you buy a Chalmers "30" your $1500 becomes worth more than $1500 invested in any other car. Careful investigation will convince you of this fact.

Please remember you are not buying a *price* or an *advertisement:* you are buying a *car.* Therefore examine the *car* on its merits.

If you investigate thoroughly a Chalmers will be your *first choice,* if you are able to get a delivery in your territory.

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It is difficult to get more in a car, at any price, than you can get in a Chalmers "Forty" at $2750. The "Forty" has all the power one can want, the quality to endure, beauty of line and luxurious finish. Seats for seven if desired. **Catalogue "R" on request.**

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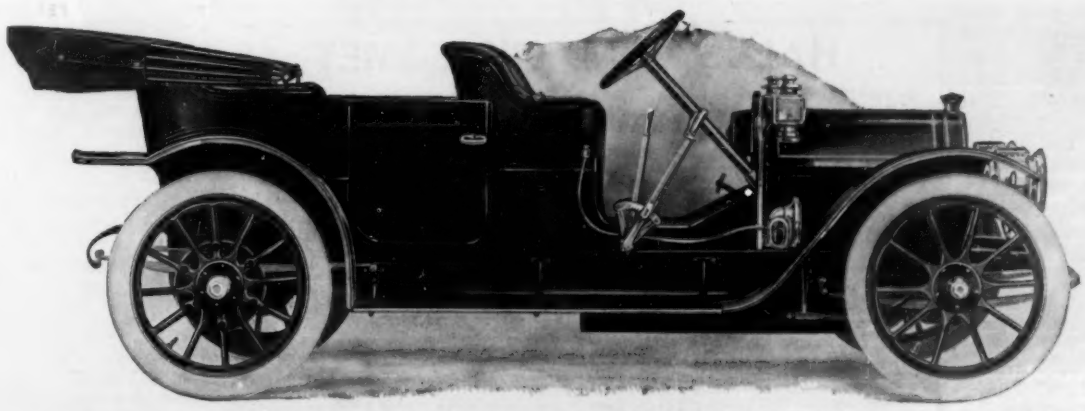

Chalmers "30" Touring Car and Roadster, $1500
Pony Tonneau, $1600 Inside Drive Coupe, $2100 Limousine, $2750

OUR SEACOAST DEFENSES.

(*Continued from page 301.*)

put out of action, there are emergency range finders installed on the flank of each battery. This range finder is the Barr and Stroud, 9-foot, self-contained horizontal base type. In case these are put out of action, ranges must be determined by means of buoys or from observation of fire.

The firing of mortars is far more difficult than that of guns. The detachments at the mortars are completely concealed. These weapons attack the decks of ships, and when fired their location cannot be discovered. They are set for elevation in practically the same manner as guns, but their direction, instead of being set on sights, is accomplished by laying the mortar on an azimuth circle. In other words, the mortar is set for an elevation corresponding to the range, and at an angle of direction equal to the azimuth of a predicted position of the target corrected for wind, drift, travel, etc. Many authorities considered mortars in past years to be so inaccurate as not to authorize their construction; but within recent years the results of tests and the records of target practice have shown that mortars are of immense value to seacoast fortifications. Several companies in our coast artillery have made as high as 80 per cent. hits at ranges of six and seven thousand yards when firing on a moving target having a speed of seven or eight miles an hour and when firing but one mortar at a time. Mortars have a particularly great value in repelling a reconnoissance in force, as they can be fired with impunity without disclosing their location.

Another important arm, if not the most important arm of defense in the coast artillery, is that of submarine mines. These weapons are designed to repel an attack when the hostile fleet attempts to come in during a fog or when the guns have been put out of action. The system is so designed as to render these mines harmless to friendly ships and to be under such perfect control of the mine commander as to permit their being fired either by contact or judgment. The electrical principles involved in the control and firing of submarine mines is kept a secret. Ten years ago it took almost two weeks to plant a group of mines. To-day, by the use of mine planters, a harbor can be completely blocked within twenty-four hours.

The work that will devolve upon coast artillery troops in time of war will be of the most trying and patience-racking nature.

It is presumed in making this statement, that no fleet commander would attempt an open attack or "run by" in broad daylight, but would await the early dawn in a partial fog, when searchlights are useless and the spirit of the men at the guns at its lowest ebb. He would, without doubt, wear the gunners and cannoneers out and try their patience by making many sorties and feints during late hours of the night and early morning before making his final attack. He would also, if possible, await his attack until cold weather set in and snow had fallen, knowing how dispiriting ice and snow are to soldiers living in tents, as they would have to do during war.

In the harbor of New York, for example, if war were declared all coast artillery would have to live in tents immediately in rear of the guns.

Would it not tend to breed discontent and dissatisfaction among soldiery if they were required to answer "call to arms" every hour during the night for about two weeks in bitter winter weather?

This is the work the coast artillery will have to do when it is called to defend our country's ports from the invasion of a foreign navy.

It will be then that the "brave, the

(*Concluded on page 307.*)

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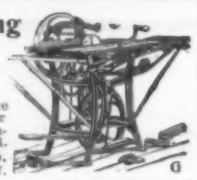

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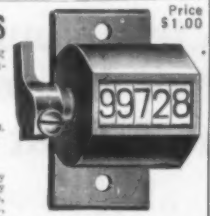

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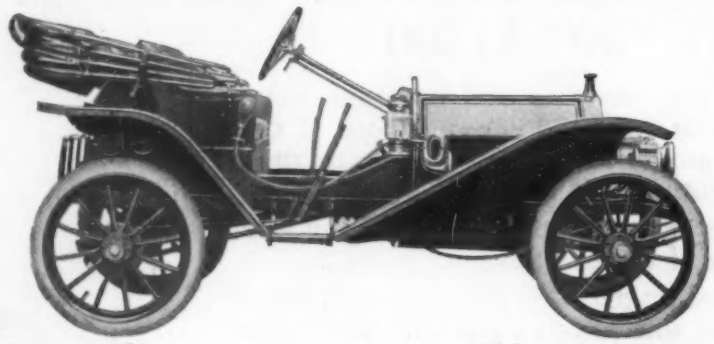

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"Compare the two power plants."

Of the power plant in the larger, costlier car, he can say with perfect truth: "This engine is no better and no more efficient than the engine of the Hupmobile."

He can go further than that. He can compare the two plants by progressive steps in the matter of: (a) design; (b) steels and other materials; (c) fineness of measurements; (d) power developed; (e) silence; (f) simplicity; (g) quality of service.

And he is able to say without overstating the case a particle:

"For its purpose and for its type, the Hupmobile power plant is not surpassed by the other.

"It cost, in proportion, just as much to produce.

"It enlisted the same high degree of engineering skill.

"It engaged manufacturing methods just as fine; and careful; and conservative.

"It incorporates the same high grade of material.

"It will render within reason precisely the same quality of service in the proportion of power produced; the quick and easy development of that power; in the matter of speed; in flexibility; in smoothness; and in all-around efficiency on the straight-away or on the grade."

In short, he is justified in saying to you that the Hupmobile is the first car of its type and size made with exactly the same sincerity of purpose (in method and material) as the leaders among cars of the larger class.

The man who owns the two types—the Hupmobile and the heavier, costlier car—will corroborate this estimate to the letter.

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Leaving Detroit December 27, 1909—just after the Christmas blizzard and the heaviest snowfall of the winter—three Hupmobiles negotiated the thousand miles between Detroit and New York City by Jan. 6. Over every mile it was a battle with the snow; and the termination of the trip—with every car fit and ready to turn back at once for Detroit—marked the successful completion of the severest task ever imposed on a car of Hupmobile size and type.

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LICENSED UNDER SELDEN PATENT

HALLEY AND HIS COMET

The year 1910 is destined to be one of the most famous in astronomical history, simply because Halley's comet has returned after a lapse of seventy-five years. Why not learn all about this wonderful comet and about comets in general by reading the following articles?

Scientific American No. 19, Volume XCVIII. **Gas Phosphorescence and Meteor Trains.** An article in which the investigations of C. C. Trowbridge of Columbia University are described, showing that the after-glow produced from a vacuum tube resembles closely the effect produced in the sky by the passage of meteors.
Scientific American No. 6, Volume XCIX. **The Mystery of Comets.** An article in which the famous comets of the last century are enumerated and described and modern cometary theories discussed.
Scientific American Supplement No. 1728. **Ancient and Popular Ideas about Comets.** Queer superstitions about the strangest of heavenly bodies.
Scientific American No. 7, Volume CI. **Halley's Comet.** An interesting article by Dr. Alexander W. Roberts, in which the general history of Halley's famous comet is sketched with comments on its past appearances.
Scientific American Supplement No. 1705. **The next apparition (1910) of Halley's Comet.** An important article by H. C. Wilson, with a map giving the position of the comet relatively to the orbits of the planets from September 15, 1908, to July 13, 1910.
Scientific American Supplement, No. 1632. **Halley's Comet.** An article by F. W. Henkel, F. R. A. S., which tells how Halley came to discover the comet which bears his name, and how mathematicians have plotted its orbit.
Scientific American Supplement No. 1770. **Edmund Halley.** A biography by J. E. Gore, M. R. I. A., of the man who dispelled cometary superstitions and popularized the law of gravition.
Scientific American Supplement No. 1773. **Light Pressure and Comets' Tails.** An explanation of the vagaries of a comet's tail, by Arthur Stanley Eddington, F. R. A. S.
Any one of the papers here listed can be supplied for 10 cents. The entire set will be sent for 80 cents. Order from your newsdealer or from

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AND EACH BEARING THAT DATE

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active, and the vigilant" will be called upon to show their true colors and "make good."

OUR CIVIL DAY.

(*Continued from page 302.*)

particular day stays on the world (the entire world) for an exact hour.

Let us trace the front end of the twentieth century by this system of progress. We again show it as having reached its eighteenth hour on earth as in the former illustration. That is to say, it has reached the 90th meridian west of Greenwich, or central time, but as central time covers 15 deg. of longitude we have sent the head end of our century to 97½ deg. west, making it arrive there half an hour too soon. We then compel it to stay there until it is a half hour late. Then it takes another jump to mountain time, which lands the 1st of January, 1900, at the 112½ deg. W. meridian, and so on. By adhering strictly to the system, let us note what happens when January 1st reaches 180 deg. Of course it must cover the 15-deg. zone, the center of which is 180 deg., thus transferring the "international date line" to 172½ deg. east of prime. The theoretical date line is thereby moved 7½ deg. ahead of the 180-deg. true line.

Before proceeding with our examination of the ragged edge of time, which local convenience demands on the hour zones or way stations, let us glance back at the first diagram of Fig. 1 and look at the theoretical line where our civil day enters, then at the former practice in regard to Alaska and the Philippines, then at the line where these two countries changed places, as it were, and finally at the line of practice as now in use (1910). The deflections of practice which appear on this terminal station of time also appear in a constantly changing and more exaggerated form on the way stations (hour zones). We have noticed how irregular the front end of the twentieth century was when it entered the earth. Now refer to Figs. 3 and 4 and see what happened to it when it progressed around the earth as far as New York city, that is to say when it reached 75 deg. west (the eastern time zone). The dotted outline of the United States enables us to see that Palm Beach, Florida, should be "ringing in" the new year and century in unison with New York city. Not so. Palm Beach is still on the nineteenth century calendar, and will be for another hour. The beach does not belong there, but as the railway managers voted it into central time in 1883, it is still held there by steel rails just as rigidly as the Tonga Islands are put in "to-day" by the steamship lines when they really belong in "yesterday," and as the more westerly members of the Aleutian Islands are kept in "to-day" when they should be in "to-morrow."

I once referred to these zone lines to a friend as imaginary. "Imaginary," said he, "I will never forget the time I passed over one when going to California from New York. My appetite was running a bit ahead of time, and I was impatiently waiting for the dining car to open up at twelve noon, as the time table said it would. The porter entered my car, and instead of the musical sounds of first call for luncheon on a dining car he shouted: "Set your watches back one hour." If his train had reached El Paso, Texas, under similar circumstances, it might have left the tracks. That is the point where the western time zone overlaps to such an extent that it actually meets an easterly deflection from the Pacific zone. The porter would have then called, "Set your watches back two hours."

To persons who have not looked closely into this complicated subject, the first question that comes to their lips is, Why not keep the date line and zone lines straight in practice as well as in theory? Suppose that you live on Main Street, Mainville, Maine, where longitude 67½

(*Concluded on page 308.*)

E-M-F 30 THIRTY

There must be a mighty solid basis for the phenomenal success that has followed the E-M-F Company from the very first.

No other Automobile Concern ever has enjoyed the tremendous success this one has. The whole world knows and all the world is talking about the Company and its cars, constantly. There must be a reason and it must be a good one. Even competitors admit that!

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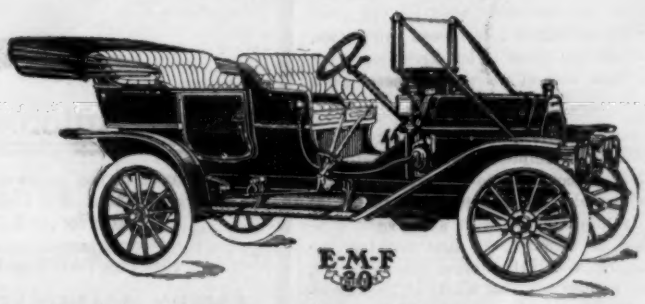

The E-M-F Co., Automobile Manufacturers Detroit, Mich.

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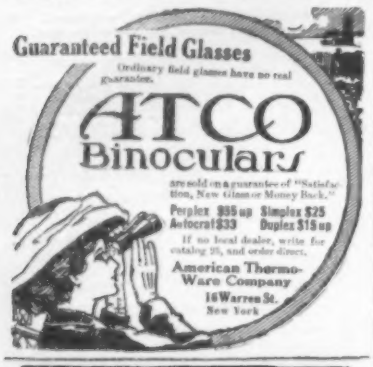

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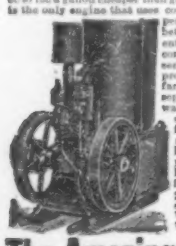

The Amazing "DETROIT."

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October 22, 1906

About four years ago, Mr. John Davey treated for us on our farm at Wickliffe, Ohio, three very large white oaks, three elms and several large chestnut trees that were badly decayed, besides quite a number of old apple trees, with great success. These trees are now in a perfectly healthy condition.

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(*Concluded from page 307.*)

deg. west of Greenwich passes right through your front parlor. You will therefore set your hall clock an hour forward and let your little mantel clock stay as it is now. Very soon you would like to deflect the line enough to at least pass outside of the walls. Then you see visions of a late delivery of milk for your breakfast, and request that the line sweep in the milk depot, then the railway station, and finally that your office be kept in the same zone of practice. Take another glance at the eastern time zone. That little bump on its edge was put there, not only to keep the line out of your parlor, but outside of the State of Maine. The mere fact that you and most of your neighbors were unaware of this deflection east of Maine is a proof that the line benders did their work well. If a very large percentage of the people of the United States knew that their zone lines were bent, it would be time to bend them into some different form.

As some readers might overlook the fact that the astronomical day begins and ends at Greenwich at noon, 12 hours later than the beginning and ending of the civil or common day (the day we sleep and eat and work by), we should make it plain that all the illustrations and remarks apply to the civil one. The astronomical day is a clean-cut straight line affair that needs no adjusting to practice. The users of this kind of a day do not try to thrust its date line aside. The observatory at Greenwich was built right on this line and to make it more realistic a bronze tablet is set in stone with prime meridian (Zero Degree) engraved on it so that it may be seen and felt by those who visit the observatory.

The Energy of a Coiled Spring.

The old question of what becomes of the energy of a coiled spring placed in sulphuric acid cropped up again before the Western Society of Engineers during a discussion on the conservation of energy. Dr. Steinmetz gave this explanation on that occasion:

The heat produced by the chemical action in a coiled spring, when dissolved, is greater by the amount of energy stored in it than if the spring were not under pressure. The amount of energy which is stored in compressing the spring in heat measure is so insignificant compared with the energy of solution that one cannot measure the difference calorimetrically, but one can prove that the compressed spring produces a greater heat in dissolving than the uncompressed spring, in an indirect manner. The measure of the chemical energy is the electrical potential difference. If one dissolves iron in an acid and the iron is under strain, partly compressed, partly not, one finds an unequal corrosion due to local current between the different parts of the iron. If there is a local current it means that the different parts of iron have different potential differences against the electrolyte, that is, different chemical affinities, and the part under strain is dissolved first, showing a greater potential difference and thus a greater heat produced in its solution. Thus, if only a part of the spring were compressed, the other part not, the compressed part would dissolve first in the sulphuric acid by the local current circulating between the two, showing that its solution gives more energy than that of the uncompressed part.

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Inquiry No. 9109.—Wanted addresses of the manufacturers of the Dion Desk Clock.

Inquiry No. 9110.—Wanted to buy machinery for reducing old tin cans, so that they may become a source of revenue.

Inquiry No. 9111.—Wanted to correspond with manufacturers who furnish nut-cracks, or similar articles.

Inquiry No. 9112.—Wanted sample small dry vacuum pump about 6-inch diameter cylinder inside, high temperature metal packing.

Inquiry No. 9113.—Wanted name and address of the manufacturers of the Russell Patent Automatic Ink Well.

Inquiry No. 9114.—Wanted name and address of manufacturer of the Auto Lantern Globe. Fits all lanterns.

Inquiry No. 9115.—Wanted a machine for making pen nibs, similar to Wm. Mitchell's G. & J. nibs and Waverly nibs.

Inquiry No. 9116.—Wanted machines to make wire netting 6 inches wide by 50 yards long, and for galvanizing the wire netting as it is finished.

Inquiry No. 9117.—Wanted names and addresse of the manufacturers of pedometers.

Inquiry No. 9118.—Wanted, a muffler for a gasoline engine, built upon the principle of the Maxim silencer, recently brought out for use on rifles.

Inquiry No. 9119.—Wanted, name and address of the manufacturer of Zeglin bullet-proof cloth.

Inquiry No. 9120.—Wanted, the address of the Ideal Fuel Feeder Co.

Inquiry No. 9121.—Wanted, manufacturers of cut stencils for fancy work, sofa pillows, etc., and oil colors and brushes for same.

Inquiry No. 9122.—Wanted, manufacturers of ditching machines used for tiledrains operated by horse power.

Inquiry No. 9123.—Wanted, names of importers or dealers in crude gutta percha and rubber.

Inquiry No. 9124.—Wanted, name and address of a company in Germany making a machine to manufacture a cement and asbestos shingle and building lumber.

Inquiry No. 9125.—Wanted, name and address of the Just-Hatmaker machine, for manufacturing milk powder.

Inquiry No. 9126.—Wanted, to buy machine for putting up and preparing condensed milk.

Inquiry No. 9127.—Wanted, address of L. Dermigny, manufacturer of a family ice machine for $10.00

Inquiry No. 9128.—Wanted, a hand planer, for metal working, in which the hand planer is made to be attached to any ordinary bench vise. The vise and the planer are combined to form only one machine.

Inquiry No. 9129.—Wanted, addresses of makers of machinery for paper box factories, or new or second-hand paper box making machinery.

Inquiry No. 9130.—Wanted, parties to manufacture a new patented shell for shot guns.

Inquiry No. 9131.—Wanted, information as to how or where I could get a sample of tin ore.

Inquiry No. 9132.—Wanted, manufacturers of a gasoline traction engine with a hoisting attachment; in other words, the machine will be used as a portable stump puller to pull sassafras roots, used in making oil of sassafras.

Inquiry No 9133.—Wanted, manufacturers of floss candy machines.

Inquiry No. 9134.—Wanted, a small hydraulic motor, capable of giving about one horse power, with a water power of 35 lbs. per square inch.

Inquiry No. 9135.—Wanted, name and address of manufacturers of the Parshall Compressed Air Ice Machine.

Inquiry No. 9136.—Wanted, the name and address of a skunk raising farm.

Inquiry No. 9137.—Wanted, a device that will braid leather strips for horse whips.

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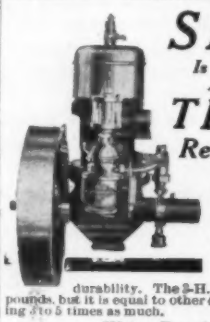

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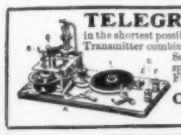

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Welding machine clamp, electric, G. E. Barstow	953,579
Wheel. See Cutting wheel.	
Wheel, Story & Winkel	953,645
Winding machines, movement adjusting device for traverse motion mechanism for, R. S. Matteson	953,388
Windmill, F. C. De Guire	953,195
Windmill, N. & J. Wagner	953,566
Window bar, G. L. Fox	953,197
Window lock, W. B. Davis	953,322
Wire stretcher, J. P. Carnes	953,257
Wiring, combined cleat and switch for house, H. R. Sargent	953,236
Wireless transmitting system, Muth & Heinkel	953,635
Woodworking machines, split cap for, C. Helbling, Jr.	953,203
Wrench, J. Newbauer	953,346
Wrench, A. R. Carll	953,515
Wrench, E. G. Hamilton	953,611
Yoke, neck, J. Hulit	953,620

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., Inc., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., Inc., 361 Broadway, New York.

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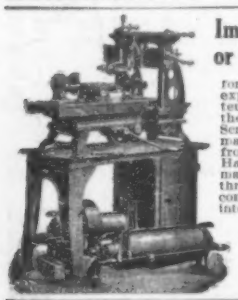

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FIFTY CARS AVERAGE CENT A MONTH

The fifty owners in Dayton, O., territory drive aggregate of 168,580 miles at total cost for repairs of $5.70, averaging 3371 miles per car and 12 cents each for repairs.

Statistics were recently published in New York showing that 75 Cadillac "Thirty" owners had driven their cars 398,884 miles at the amazingly low repair cost of $53.21.

It was said at the time that they constituted the most remarkable record of the kind in the history of transportation.

Hard on the heels of the New York achievement comes the claim of a second city, showing a still lower cost of upkeep than has ever been recorded.

The 75 Cadillac owners in New York city expended an average for the year of 71 cents per car, while the 50 owners in Dayton, O., and vicinity show a total cost for repairs of $5.70, or the insignificant average per car of 12 cents for the entire year, or 1 cent per month per car.

The 75 New York owners were not aware that their travels and their expenses were to be made a matter of record, and the 50 Dayton owners were likewise unconscious of the fact that they were rolling up a world-breaking record.

In both instances the cars were simply driven at the will of the owners anywhere and everywhere. There was no particular striving for economy, no more than any user would naturally give his car.

Of the 75 Cadillac owners in New York, 46 had no repairs at all—and Dayton shows a more remarkable achievement than this.

Of the 50 Cadillac owners in Dayton territory, 45 had no repairs and only five had any expense whatever.

Of these five the highest expenditure was that of A. G. Rundle, of Piqua, O., whose car cost him $2.60 during the year, and was driven a distance of 20,000 miles. The next highest expenditure was that of C. F. Kettering, of Dayton, who spent $1.50; the next was that of W. H. Nye, of Ironton, O., who spent 75 cents; the next, G. W. Bahn, of Greenville, O., who spent 50 cents, and the fifth and and last was Matt Marr, of Miamisburg, O., whose car cost the enormous expenditure of for the entire season of 35 cents.

The New York cars traveled a distance approximate to 16 trips around the world and the 50 Dayton Cadillacs traveled a distance equivalent to nearly seven trips around the globe.

Dayton comes to the front with some figures on gasoline consumption which are almost equally interesting, as the amazingly low cost of upkeep. For instance, the average of fuel consumption for the 50 Dayton cars shows 17 miles to the gallon of gasoline for the touring car, and 20 miles for the demi-tonneau. One owner particularly writes that he averaged, for 4,000 miles, 21 miles per gallon of gasoline, and over 300 miles on a quart of oil.

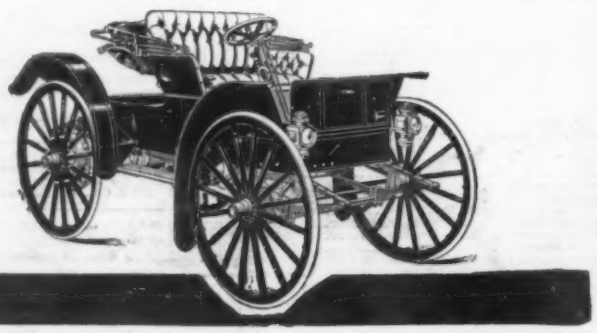
Coming one on the heels of the other, these two statements have been among the principal topics of discussion in the motoring world.

While it is possible that there may be other makes of cars which can show cases of low upkeep cost in occasional instances, yet it is safe to say that the records here cited, taking one type of car as a whole, have never been even approached in motor car history.

The manufacturers of the Cadillac, while naturally gratified, take the stand that the experience of New York and Dayton owners is probably duplicated in every locality in the United States where a considerable number of Cadillacs are driven.

They point to uniformly low cost of upkeep as proof of the well-known policy which the Cadillac company has held from its inception; that the perfect car and the car of greatest economy must, of necessity, be the result of complete standardization.

They contend that New York and Dayton have simply confirmed what has been known to the builders of the Cadillac and to hundreds of users in past years, to wit: That the Cadillac is an exemplification of scientific design and accurate workmanship which has no parallel in the industry.



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